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FOOD MANUFACTURE

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CONTENTS

	PAGE
Editor's Comments	109
Coal as a Fuel in the Food Industry *by H. L. Pirie, M.I.Mech.E.*	113
Pulverised Coal	117
Steam Economy by Correct Steam Trapping *by L. G. Northcroft, B.Sc.(Eng.), A.M.I.Mech.E.*	118
Gas in the Food Industry	120
Electricity as a Source of Heat for Food Manufacturers *by L. H. Carmalt*	122
Liquid Fuel in the Food Industry	125
The Testing of Fuel	126
Fuel Research *by Dr. F. S. Sinnatt, F.R.S.*	128
Fuel Plant and Machinery	129
Does Your Business follow the Law of Organic Growth? *by E. F. Brayham*	133
The Threat to the Jelly Tablet *by E. J. Thomas*	137
Book Reviews	140
Generalities	141
Correspondence	143
New Companies	144
Trade Marks	144
Information and Advice	145
Recent Patents	146

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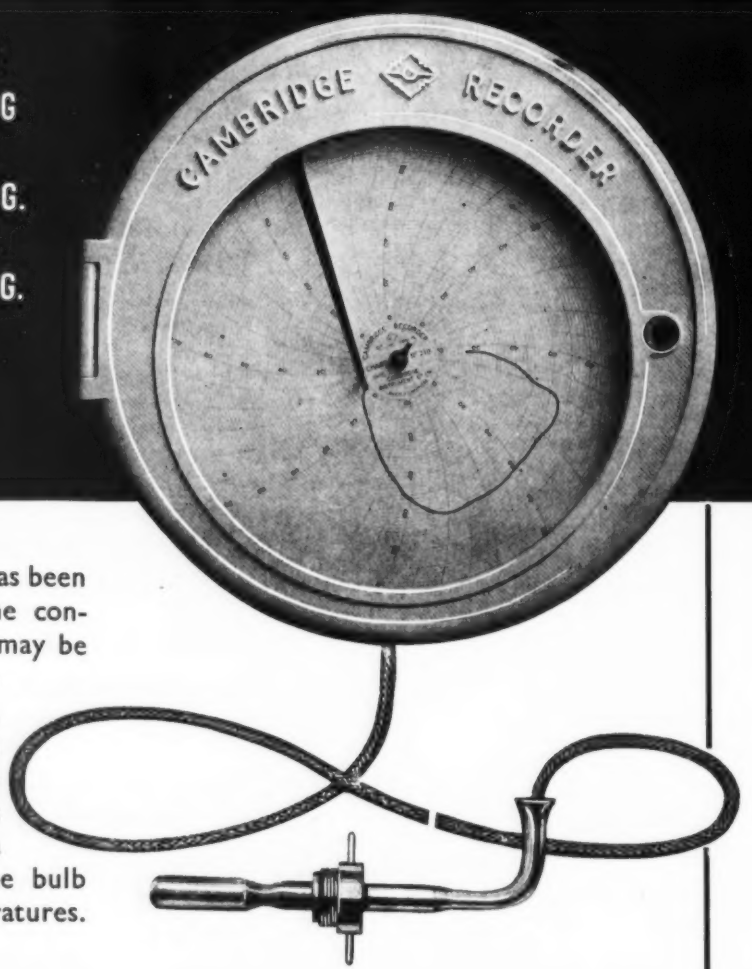

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FOOD MANUFACTURE

Vol. XIII, No. 4 April, 1938

The Wheat Act

OUR NOTE headed "Two Sides" in last month's issue seems to have caused a little misunderstanding. Possibly we did not make our argument as clear as we might have done. Moreover, in the milling industry there is a considerable overlapping of terms and a resultant confusion. In some mills the word "middlings" refers to a semolina stock, whereas in others it refers to offal, now known generally, but not entirely, as weatings. A correspondent has written pointing out that he understood that the court judgment we referred to applied to offals and not to semolina or middlings. If he is taking the term "middlings" in the sense of a fine milling stock to be later converted into flour, we agree, but, as already stated in many mills, the word "middlings" means offal. We take this opportunity of clearing the matter up a little. Semolina imported as such certainly pays the quota imposed by the Wheat Act, and a drawback to the extent of the quota charge is allowed on all semolina produced here and exported. We never intended to convey the idea that semolina did not pay quota; what we did mean to say, and what, in fact, has actually happened, was that semolina masquerading under the name offal, weatings, fancy middlings or whatever trade name is given to this type of offal, would escape the quota. Our correspondent informs us that he has paid quota on all his imported semolina. Quite right, too, and we rather imagine that he will welcome the effort of the Wheat Commission to prevent other firms avoiding payment of quota by obtaining semolina mixed up with offal.

The Food Council

The Food Council, under the chairmanship of Mr. Geoffrey Peto, is an active body. A short while ago it issued a very comprehensive report on the Milk Marketing Scheme and made a number of shrewd and welcome suggestions. Among these were some relating to the fixing of minimum retail prices. If these are to be fixed the Council considers that they ought to be fixed by an independent body and not by agreement between the producers and distributors only. This coincides with our frequently expressed opinion that outside control is the only possible hope for the milk industry. The elaborate distributive service to which we have also called attention is referred to and the conclusion is reached that, "the tendency in fixing minimum retail prices must be that the higher standard of service is accepted as the basis, with the result that margins are fixed which are too liberal to many of the distributors performing the relatively simple service". Finally, the important point is made that if minimum retail prices cannot be fixed with fairness to consumers, the retail price should be entirely freed. Undoubtedly the present system of price fixing is irksome to the public, and even if the Government do not see their way to adopt the recommendation of the Cutforth Commission that wholesale prices should be fixed by an independent body and that retail prices should be left free, something ought to be done to put the representatives of the consumers in a stronger position than they have hitherto held. The Food Council also considers that legal standards of butter fat content should be prescribed for both full and single cream and hopes that legislation will soon be introduced to this effect. The Council has called attention to the deception of consumers owing to the absence of control over the quantities contained in cartons, and desires standardisation of all containers, a point with which we are in complete agreement.

Lethargy Again

We are continually being brought face to face with flagrant cases of procrastination by the Government. On February 15 this year the President of the Board of Trade was asked why the recommendations made by the Import Duties Advisory Committee relating to ham and bacon preserved in air-tight containers, and dated March 5, 1936, were not published till last month! He was

also asked what action the Government proposed to take upon the recommendations. The reply was that a decision in these recommendations was deferred pending discussion with representatives of the principal foreign supplying countries. We should have thought that in ordinary business circles such conversation would not be prolonged over a period of nearly two years. At any rate, after all these months of talk, all the Board of Trade can announce is that arrangements have now been made for reducing the exports to this country to a level which should enable United Kingdom manufacturers to secure a satisfactory share of the home market. Therefore, it has been decided not to give effect to the recommendations of the Committee. Again the Government have fallen into the trap of voluntary limitation of exports to Great Britain. Some years ago there was an attempt at voluntary limitation of wheat exports to this country, but as soon as Argentina found herself with a surplus she broke her quota. We also remember the disastrous results of the Government's attempt to provide the home bacon curers with a share of the home market. We bought less from the foreigner and paid more for it, with the result that prices to the consumer went up. In the present circumstance, when Sir Percy Harris asked if these new proposals to limit supplies would not raise prices to the consumers he was vouchsafed no answer. It was ever thus.

More Jams

It is surprising to note how many attempts at some form of evasion of the official standards are made in the jam trade. It may be that the Inspectors are a little keener on jam examinations than other commodities, but whatever is the reason every month sees a fresh crop of prosecutions. In our January issue this year we referred to the large and increasing number of offences, and it does not appear as if there is any likelihood of immediate abatement. Recently a firm of multiple stores operating from London were summoned for selling strawberry jam deficient in fruit at one of their stores in Wolverhampton. This was a bad case. The label on the jar stated that the product conformed to the standard of the Food Manufacturers' Federation. As is generally accepted among analysts, this standard in the case of strawberries is not by any means high, the minimum fruit content being only 42 per cent. In this case there was a deficiency of 50 per cent. of this low standard. The defence was rather lame, and to the effect that the fruit was not evenly distributed in the whole batch, and that probably other jars contained more than the necessary amount of fruit. This suggestion was rather negatived by the fact that an informal sample taken previously had an even greater deficiency. We consider that the supplying of jam with less than the requisite amount of fruit is a particularly mean type of fraud, as it affects chiefly the poorer classes. The middle and upper classes usually have home-made jam, but the bulk of manufactured jam goes to working-class homes, especially in the North, where a "jam buttie" (a slice of bread smeared with jam) forms the basis of many a child's main meal. Any manufacturer found guilty of such practices and to such a flagrant extent as a 50 per cent. deficiency should be punished to the utmost limits and, if caught again, should be prohibited from manufacturing jam.

Soil Fertility

One of the most vital problems of the day in connection with food supplies is the question of soil fertility. Sir Thomas Inskip quoted in the House of Commons debate an official calculation showing that there had been an increase of 19 per cent. in home production of food in the last six years. Does this really mean that we are actually producing more, and, if so, is it at the expense of soil fertility? The official calculation of the agricultural output is based on a calculation of the value of all farm products such as milk, pigs, eggs, as well as corn, vegetables and other actual products. The total assessment may show an increase, but this may not mean that there has been any increase in production from the land itself. Actual figures show that in 1937 a total arable acreage was about 200,000 acres less than in 1931. As to livestock, there were about 200,000 more cows in milk and nearly a million more pigs in 1937 than in 1931. The gain in pig meat, milk and eggs has contributed largely to the official increase of 19 per cent., to which Sir Thomas Inskip referred. These products, however, are largely dependent on imported feeding stuffs, and the increased purchases of imported feeding stuffs to carry the extra pigs and cows has been at the expense of arable farming. How this will ultimately affect soil fertility is a difficult question to answer. The dairy cow makes tremendous demands on the pastures and hence on soil fertility. The proteins and other foods sent away from the farms every day in the milk churns must come from somewhere and their loss be made good. In addition to all this, the one arable crop which has been increased—wheat—is the most greedy and impoverishes the ground more

than any other crop. If our agricultural industry is to be of real value in time of war the question of soil fertility should be dealt with now.

American Canning Convention

It would be difficult to find any angle of the canning industry which was not treated during the recently held Thirty-first Annual Convention of the National Canners' Association at Chicago. To any member of the industry, be he manager, sales executive, chemist, or engineer, the papers read may serve as mental *pabulum* for a considerable time.

American methods are sometimes criticised on this side of the " herring pond ", but there is little for the British canner to carp at and not a little he can learn from the Convention. Its value has already been proclaimed by some of our most prominent canners, not only by their presence but also by their praise.

Of special interest to the sales side is a paper read by Judge J. Harry Covington entitled, " The Industry and its Public ". In common with its British counterpart, the American canning industry has suffered and apparently is still suffering from what the author calls " subversive propaganda ". He considers it necessary to divide the public of the industry into several groups in order to combat such propaganda. While placing in the first and most important place the housewife who purchases canned foods for direct consumption, he separates the producers from whom the raw materials are purchased, the labour which is employed in its processing and the distributors to whom the canner sells his goods. Judge Covington stresses that there is a need for a special missionary story for each of these groups—a point which merits the attention of the canners in this country.

We feel that there is still something lacking in our propaganda. The ignorance which still exists as to the nature of canned foods was again demonstrated in the House of Commons a week or so ago when a member asked whether typhoid fever had ever been traced to canned foods. If our legislators (who might reasonably be expected to be well-informed) wallow in such ignorance, is the average housewife likely to know exactly what happens when food is canned and that the essence of canning is the destruction of micro-organisms? But she could be told in simple language. She reads the newspapers; listens to the " wireless "; goes to the cinematograph. They are very much alive to the consumer in the United States, although evidently not satisfied that everything has been done about him that might or ought to have been done. In this country, apart from individual effort, a few suggestions are given at our Convention and that's the end of it!

Canning Science

The annual report to the Research Committee, presented by W. D. Bigelow, indicates the varied and profound nature of the studies carried out during the year 1937.

For ten years, bacteriological surveys have been made in canning plants engaged in packing non-acid products. That due advantage has been taken of these surveys by the canners is evidenced by the fact that on the occasion of a second survey of the same plant, abnormal contamination is exceptional. A point of considerable interest is stressed in connection with new plant. It has been found that when a new type of canning plant is brought into use or when substantial changes have been made in the construction or use of canning equipment, new spoilage hazards are sometimes introduced that require additional precautions to prevent bacterial contamination.

Over a period of 15 years a large volume of work on the vitamins has been performed in collaboration with Dr. Walter H. Eddy, of Teachers' College, Columbia University. It appears that the vendors of vitamin concentrates at one time disseminated statements regarding lack of vitamins in canned foods, to the detriment of the canners. The results of those years of work (at the early part of which the vitamins themselves were not properly understood) have successfully disposed of the " vitamin fallacy " and, so far as the Association is concerned it is considered that sufficient work has been done and is being continued in other laboratories to warrant the discontinuance of further research on the subject and thus allow funds to be devoted to other and more urgent studies.

In this country, as in others where canning research is active, the vitamin question has been satisfactorily settled, although whether it has been sufficiently publicised is a moot point. We wonder whether the *majority* of the medical profession know about it?

Turning to some further work reported at the Convention, there are processing studies from which valuable data has been collated as a result of the employment of the spores of test organisms in specific concentrations.

The thermophylic contamination of sugar and starch received attention and a number of results

were tabulated. This is a subject which has also received attention in this country. Two articles appeared on the subject in the January and February issues of this journal.

The foregoing is merely a selection from the field covered. Abstracts from the principal papers will in due course be found in our pages.

Pigs and Bacon

The new proposals of the Government for the reorganisation of the home-produced bacon industry have been met with lukewarm enthusiasm. Some sections consider that they have not gone far enough, others think that the amount to be spent is not sufficient.

Mr. A. E. Marsh, of the Bacon Development Board and the Bacon Marketing Board, feels that the most helpful proposal is that £50,000 is to be set aside annually for research into the problem of producing home-cured bacon from home-bred pigs capable of maintaining and imposing its prestige in the home market. Of the sum, one-half is to be contributed by the curers and the other half by the producers. Mr. J. A. Fox, Chairman of the Pig Marketing Board, is disappointed that the degree of assistance is not greater. He does think, however, that the stability offered will encourage suitable production. The arrangement does not satisfy the National Farmers' Union, who consider that the new prices fall short of the minimum put forward on behalf of the producer. Operated over a period of three years the guarantee will, they think, appeal sufficiently to the larger producers to ensure the delivery of the requisite number of pigs.

However opinion may differ, there is little doubt that the Minister of Agriculture has been confronted with a difficult task, especially when all previous attempts to organise the bacon industry are considered, and undoubtedly the scheme is a step in the right direction. It seems that his main desire has been to co-ordinate the pork marketing with the bacon industry so that neither will suffer price fluctuation consequent on market conditions.

Powers to allocate supplies are vested in the Bacon Marketing Board, if necessary preference being given to the most efficient factories.

Guaranteed Prices

Guaranteed prices under the controlled system are expected to start by July 1, by which time pig producers should know sufficiently how many pigs they mean to put under contract during the first year, but the number may be disappointing because the pig proposal at the present time is not large enough to fill the factory requirements, especially with the approach of summer months and probably increased consumption.

Under the scheme the number of curing units will be reduced. The sale of pigs to curers on annual contract will be restored. For a period of three years the following financial arrangements are proposed.

In the first year pig producers will receive in respect of pigs of a prescribed standard produced in Great Britain and delivered to bacon factories in fulfilment of annual contracts a basic price of 12s. 6d. a score dead weight, when the cost of a standard feeding-stuffs ration is 8s. 6d. per cwt. To enable this basic price to be paid, curers will be compensated from the Exchequer in the event of any fall in bacon prices below a notional price of 94s. 9d. per cwt. Pig producers will be similarly compensated in the event of the cost of feeding-stuffs ration exceeding 8s. 6d. per cwt. In the second year, the basic pig price will be reduced by one penny per score and the notional bacon price by 1s. per cwt. In the third year the price for pigs will be reduced by a further 2d. per score and the notional bacon price by a further 2s. per cwt. If during the three-year period the cost of feeding-stuffs falls below 8s. 6d. or bacon prices rise above the notional figure, there will be a corresponding recoupment by the Exchequer.

Milk Shortage

A warning regarding the danger of a milk shortage was given at a farmers' club dinner at Fareham, Hampshire, recently. Mr. Sidney Forster, General Manager of the Milk Marketing Board, said that if an emergency arose we should find ourselves in an infinitely worse position than we were during the war. A great deal was being done to co-ordinate defence plans, one of which related to assuring food supplies, but as far as milk was concerned he had never known such a short supply as there had been in the last two or three months. Last month, after we had satisfied the requirements of the liquid market and the cream and condensed milk markets there were only 2,000,000 gallons of milk left for cheese and butter making—an infinitesimal amount compared with the quantity required. The Board felt that they should be able to work on an expanding policy. The restriction of price and standard qualities which the Government were introducing did not give scope for development which should be given to dairying.

A Symposium on

FUEL

for the Food Manufacturer

Coal • Gas • Electricity • Oil

as sources of heat

COAL

as a Fuel in the Food Industry

By H. L. Pirie, M.I.Mech.E.

(Chief Engineer, Coal Utilization Council)

ACCORDING TO the Summary of the Census of Production published in the *Board of Trade Journal*, the consumption of solid fuel by the Food, Drink, and Tobacco Trades in 1935 amounted to very nearly 5,000,000 tons.

It is true that the proportion which the cost of this fuel bears to the total cost of materials, fuel and electricity is relatively small—about 1¼ per cent. on the average; but the actual cost is nevertheless substantial, and in view of the tendency of all costs of production to rise it is obvious that any economy that can be effected in the generation, transmission, or use of heat must be a matter of considerable importance to the Food Industry.

Broadly speaking, solid fuel is used in the Food Trades primarily for steam raising, the steam being used both for power purposes and for processing. Broadly speaking again, the boilers in most general use in these trades are of the shell type such as the Lancashire, and the following information may be useful as indicating how economies can be effected and waste prevented in the generation of steam with this class of boiler.

There are two main reasons why Lancashire boilers are favoured for industrial purposes. First, they are reliable even when overloaded, and, secondly, their large water capacity makes them splendid heat accumulators, so that they can take care of varying loads without undue fluctuation of pressure.

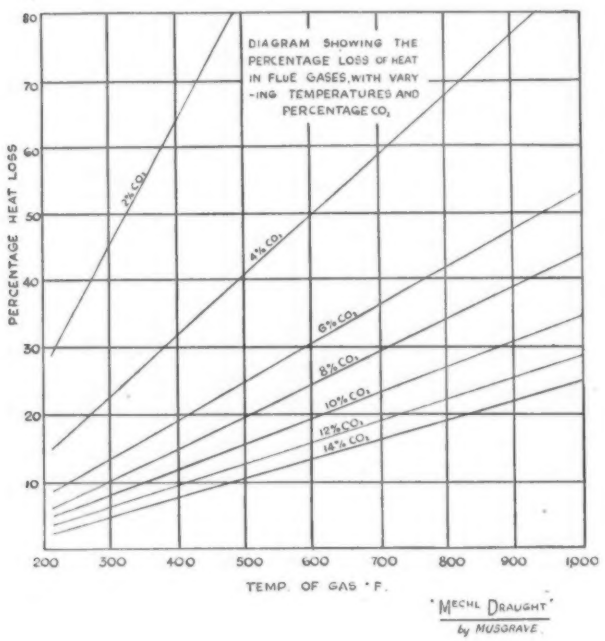
On the other hand, although efficiencies of over 80 per cent. are possible with this type of boiler and modern accessories, it is probable that the average efficiency in practice at many works does not exceed 50 to 60 per cent., which means that from a quarter to a third of the fuel is being needlessly wasted in many boiler plants to-day.

Avoidable Losses in Boiler Plants

One of the best means of improving the efficiency of a boiler plant is to investigate the various losses of heat which are taking place. The principal source of loss is the heat carried away in the flue gases.

If it were possible to burn the coal with just sufficient air for complete combustion, the flue gases would contain between 18½ and 19½ per cent. of CO_2, according to the class of coal used. This is equivalent to about 7·65 lbs. of air per 10,000 B.Th.Us. liberated.

In practice a considerable amount of excess air must be supplied to the furnace to ensure complete combustion of the fuel and of the gases above the fire bed. Too great an excess of air supply is, however, a direct source of heat loss, as this air is heated to the temperature of the gases leaving the boiler.



The chart shows the percentage heat loss in flue gases at various temperatures plus CO_2 content. A well-operated boiler should show about 12 per cent. CO_2 with hand firing, and this can be increased to about 14 per cent. with mechanical stokers. Efforts to obtain higher CO_2 readings may result in some unburned combustible gas escaping from the furnace.

Suitable measuring instruments, such as draught gauges and CO_2 recorders, are essential for the effective control of a boiler, but if these are not available the fireman should endeavour to keep a high CO_2 by finding the best fire thickness for the fuel being burned and regulating the draught by the damper to just maintain the steam pressure. If the average daily steam demand is steady, the coal consumption is a guide to the boiler efficiency.

The grates should always be completely covered with fuel. Holes in the fire allow large volumes of excess air to enter the furnace, and in the case of heavily loaded plants this causes low boiler efficiency, clinker, and insufficient steam.

With hand firing the fires should be between 4 in. to 8 in. in depth, according to the size and class of fuel and the amount of furnace draught.

Firing tools should be used as little as possible, and care should be taken during cleaning out to avoid wastage of unburned coal in the ashes.

Infiltration of Air

Another source of loss is the infiltration of air through the boiler-setting into the flues. This is equivalent to increasing the excess air supply and causes additional heat to be carried away in the flue gases. It is essential for economical operation that the boiler brickwork should be kept airtight on the outside. Leakage can be detected by going over the joints and suspected cracks with a lighted taper or candle. It is often surprising at how many places the flame is "drawn in" or actually extinguished. These cracks should be stopped by caulking with fire-clay cement to which fibres of asbestos have been added and the whole setting coated with a compound—such as tar and cement—which is impervious to air. Any air in excess of that required for complete combustion of the coal merely means that fuel is being needlessly wasted in raising its temperature to that of the flue gases instead of being used to heat the water of the boiler. Furthermore, this cold air impairs the draught. When it is remembered that for every ton of coal burned the chimney has to remove at least 19 tons of combustion products, it will be realised that any excess air imposes a heavy additional duty on the stack which it may not be able satisfactorily to perform.

Draught Intensity

Considering the large ratio of air to coal that is necessary for combustion, it is most important that there should be sufficient chimney draught to burn the coal at a rate high enough to give the steam output without forcing the fires. Generally speaking, "slacks" require a greater draught intensity than sized coals for a given rate of burning, and in most cases where the natural chimney draught is limited it may be advisable to consider installing an induced draught fan.

Even when forced draught furnaces or stokers are used there must be sufficient chimney draught to draw the gases away from the furnace. Working with positive pressure in the furnace is unpleasant for the boiler-room staff and may be the cause of expensive maintenance charges on the brickwork and furnace fittings.

As a guide it is advisable to aim at a draught intensity in the furnace of at least 0·25-in. water gauge, and preferably 0·5-in. in cases where there is a heavy demand on the boiler.

As the demand for steam varies the chimney dampers should be adjusted so as to regulate the draught according to the amount of coal being burned. Leaving the boiler dampers wide open irrespective of low variations is an expensive method of operation.

Utilisation of Heat in the Flue Gases

By Economisers: It is generally recognised that the effect of raising the boiler feed-water temperature by 11° F. increases the boiler efficiency by 1 per cent. In the case of the Lancashire boiler the outlet gas temperature may be as high as 800° F., and with economisers this can be reduced to between 350° F. and 450° F. The saving in fuel will vary with any particular plant, but 10 per cent. is probably an average figure.

FINAL EFFICIENCES OBTAINED

INITIAL EFFICIENCES AS OBSERVED	45	50	55	60	65	70	75	80	85
40	11·2	20	27·2	33·3	38·5	42·8	46·7	50	52·9
45		10	18·2	25	30·8	35·7	40	43·8	47·1
50			9·2	16·7	23·1	28·6	33·3	37·5	41·2
55				8·3	15·3	21·3	26·7	31·3	35·3
60					7·7	14·3	20	25	29·4
65						7·2	13·3	18·8	23·6
70							6·7	12·5	17·7
75								6·3	11·8
80									5·8

Diagram showing percentage of fuel tonnage saved by increased efficiency.

NOTE: With an increase in efficiency it usually follows that more steam is made. If this steam is required in the works, the savings will not be realised as cash, but as increased factory output. Example: (Initial efficiency, 60%; final efficiency, 75%) = 20% fuel saved.

The diagram shows the fuel savings possible by raising the boiler efficiency. As an illustration, if the initial efficiency is 60 per cent. and this is improved to 75 per cent., there will be a 20 per cent. saving in fuel.

By Feed-Water Heaters: In some cases it may be difficult to instal an economiser owing to lack of space, but if there is a supply of waste steam this can be used for heating the feed water to a temperature of from 180° F. to 210° F., according to the type of feed pump. The feed-water heater is really a heat exchange apparatus absorbing useful heat from the low-pressure steam.

By Superheaters: It may be considered advisable, according to the use to which the steam is to be put, to instal a superheater as well as an economiser in the path of the gases after they leave the boiler heating surfaces and before they enter the chimney.

Superheaters are being increasingly used for land purposes. The superheater does not increase the pressure of the steam, but merely increases its temperature.

The primary object of the superheater is to reduce loss due to condensation. If superheated steam is supplied to an engine, initial cylinder condensation is reduced, as also is the erosive action, resulting in less wear and tear of pistons and valves, and consequently less steam leakage. When steam is used for process purposes, saturated steam may be necessary for quick heating, and the advice of the makers of the equipment should be followed.

By Airheaters: The use of airheaters is another method of reducing flue gas temperature and thereby increasing efficiency, but it is well to point out that the use of highly preheated air for combustion may restrict the number of coals which can be satisfactorily burned, as with certain coals excessive slagging and clinkering may be experienced if heated air is used. Air with a moderate degree of preheat should not seriously limit the available fuels, and is an advantage in preventing smoke and increasing the boiler output.

While such appliances are conducive to economy, they have the effect of reducing the intensity of the draught, and before deciding to instal them it should be confirmed that sufficient draught will be available to burn coal at the rate required to give the output of steam required, as otherwise induced draught fans might have to be fitted.

The Selection of Fuels

The average buyer does not appreciate the complexity of the problem of coal selection.

While any appliance will burn practically all coals with some degree of success, no appliance is a commercial success with every fuel. Hence coal selection must precede coal purchase, and it is always better to buy up to quality rather than down to price, because fuel cost does not necessarily follow fuel price. What the purchaser is concerned with is the quantity of coal used in a given period multiplied by its price, or the cost of raising a unit quantity—say 1,000 lbs.—of steam.

As an example, to show that tonnage price does not always give an indication of the commercial value of a fuel:

Three coals, all suitable for a particular plant, at 22s. 9d., 22s. 4d., and 18s. 9d. per ton were tested. The respective evaporations were 8·62, 7·7, and 6·5 lbs. of water per lb. of coal, and the cost of coal 14·14d., 15·53d., and 15·45d. per 1,000 lbs. of steam generated. From these figures it can be calculated that the price value to the consumer of the coals from a steam-raising point of view were 22s. 9d., 20s. 4d., and 17s. 1d., and not 22s. 9d., 22s. 4d., and 18s. 9d. as quoted. In other words, it would have cost more over a given period to generate steam with the cheapest coal, and parity of steam cost with the 22s. 9d. fuel would not be reached unless the coal costing 18s. 9d. could be purchased for 17s. 1d. per ton.

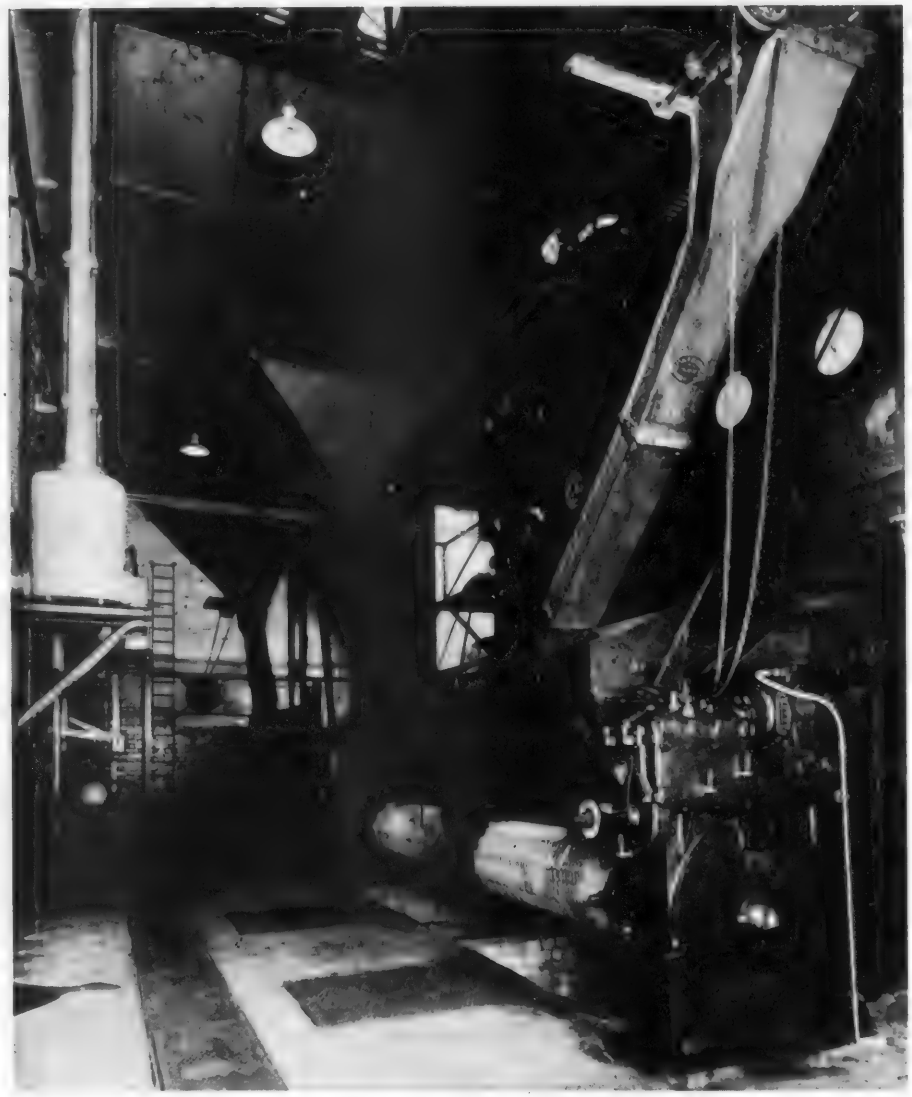
Approved methods of stoking to secure economical and smokeless combustion call for a certain degree of skill, conscientiousness, and intelligence on the part of the fireman. All firemen, unfortunately, do not possess these characteristics, and, in order, so far as possible, to be independent of the human element, machine firing has been introduced.

The use of mechanical stokers is extending rapidly, and some of the reasons for this are:

1. The boiler output can thus be increased by from 50 to 75 per cent. as compared with hand firing.

2. Higher boiler efficiencies are possible, as there is no need for continual opening of the fire-door, and the fuel bed can be maintained in such a condition as to reduce the amount of excess air to the minimum.

3. Hand firing of bituminous coal on heavily loaded boilers may result in smoke emission, but a suitable type



An installation by Babcock and Wilcox, Ltd., at the United Dairies, Ltd., Melksham.

of mechanical stoker will burn the same class of fuel smokelessly.

4. Forced-draught stokers will burn fine fuels that are unsuitable for hand firing with chimney draught, but precautions must be taken to guard against grit emission.

All mechanical stokers are designed to feed the coal continuously in small quantities, and hence greatly tend to the reduction of smoke.

Mechanical Stokers

Mechanical stokers for Lancashire boilers are of three main types: the coking stoker, which imitates the coking system of hand firing; the sprinkler type, which copies the spreading system and distributes the coal evenly over the whole area of the fuel bed; and the underfeed, by which the fuel is fed upwards from the bottom so that the smoke-producing volatiles are compelled to pass through the glowing mass and are there consumed.

For boilers which are heavily loaded, fine high ash clinkering coals are unsuitable, and for hand firing a sized coal about 2-in. cube is to be recommended. For coking stokers a sized free-burning or slightly caking bituminous coal not over 1½-in. cube is highly satisfactory. Slacks from 2 in. to dust can be burned, although at a lower rate than sized coal, provided they are of a slightly caking nature. If, however, they have a low caking index, undue ashpit loss is likely to result. This type of stoker generally works with induced draught and is not suitable for strongly coking or low-volatile coals.

Sprinkler stokers should preferably be fed with a sized coal, singles ½ in. to 1 in. being probably the best. This type of stoker can be supplied for induced or forced draught operation, and is to be recommended if sized anthracites or anthracitic coals are to be used. The underfeed stoker is designed for burning bituminous coal smokelessly, and enables certain strongly caking coals to be used. Generally it is not used for low-volatile coals, although some makes of machine can be specially adapted for these fuels.

Soot and Scale

Soot and scale are both poor conductors of heat, and, if allowed to accumulate, the efficiency of the boiler will be impaired. They should be removed periodically. In

regard to the removal of scale, a stock boiler compound should never be used. The water should be analysed and a specially prepared compound made up to deal with it. In some cases, where the water is very hard, the installation of a water softener might well be considered, but it is important that, if such an apparatus be used, attention be paid to it to ensure that the reagents are not wasted.

Efficiency in the Use of Steam

It is not always realised that serious waste can occur in the *transmission* of heat, even if it has been *generated* with the maximum efficiency; and, indeed, general operating costs can in many cases be materially reduced more readily by preventing heat losses than by concentrating on high boiler efficiency.

One of the commonest causes of heat loss is exposed steam piping, and a simple calculation will show how serious this loss can be. For example, 100 ft. of 6-in. steam pipe can be the cause of nearly 50 tons of fuel wastage in the course of a year, which could be saved by suitable lagging of the pipes. Steam-jacketed pans and other heating vessels are not always insulated, and as they have considerable exposed areas the loss of heat by condensation can be high.

Steam escaping from faulty joints or valves is an obvious source of loss which can be stopped by an efficient maintenance staff. In steam heating systems it is not uncommon to find that the condensate from jacketed pans and machines is drained through an open-ended pipe with a hand valve left in charge of the workmen. Steam is frequently seen leaking away with the water, and at the small expense of a steam trap the steam can be stopped and the hot water returned to the boiler feed-water tank.

The return of hot condensate lowers the fuel consumption and the amount of raw make-up water.

When there is a source of exhaust steam such as from centrifuges, engines, or pumps, this can often be used for heating water for process work or the boiler feed water in conjunction with a suitable heater.

Further, boilers should be fitted with a water meter, the readings of which should be noted at regular intervals, together with the coal consumption. These readings give a daily or weekly record of the amount of water evaporated per lb. of fuel. One long period boiler test under close supervision will give the maximum evaporation of which the plant is capable, and forms the basis of comparison for the weekly performance.

The water-coal ratio immediately shows if any defects are developing in the plant, and is the only practical basis for comparing the commercial value of different coals. The efficiency of the boiler-room staff can be judged from this ratio, and it forms the best basis for any bonus system for the firemen.

PULVERISED COAL

Pulverised coal has attracted a good deal of attention during the last few years, since the burning of coal in a pulverised form offers a means of attaining a much-desired increase in efficiency in the use of coal and, at the same time, of eliminating the black smoke which is still such a characteristic of our industrial areas.

The idea is not modern; coal in a pulverised form was used some seventy-five years ago by an ironmaster in the Midlands, who realised that if coal were ground to a fine powder the process of burning could be made much more efficient. But at that time fuel economy and smoke abatement were of little account, and the process languished until the advent of the rotary cement kiln stimulated investigation into methods of pulverising; since that time, and particularly during the last fifteen years, the use of pulverised coal has grown very rapidly.

The advantages of burning coal in a pulverised form are many. First of all, it is the most economical method and saves coal, since combustion is complete, no combustible matter remaining in the ash. Secondly, it offers a solution of the black smoke nuisance with its prejudicial effect on health and the amenities of the countryside. Thirdly, it enables coal, a British product, to be used with advantage for many purposes instead of oil, which must be imported from abroad. Further, it enables waste or inferior coals to be used with high efficiency.

The equipment used is a self-contained unit pulveriser which pulverises entirely by attrition. It consists mainly of a feeder, metal separator, pulveriser, and fan.

The coal is fed into the hopper and descends on to a horizontal rotating disc; the feed of coal to the machine is regulated by an adjustable knife which scrapes the coal off the disc.

From the feeder the coal drops to the separator, where all metal and substances heavier than coal are rejected. This is effected by a current of air which carries coal into the machine, but allows heavier materials to drop through a discharge chute.

The coal now enters the pulverising compartment, where a number of swinging hammers beat it against a screen-ring which partially surrounds them. By this treatment the coal is reduced in size sufficiently to be carried over the periphery of the rotor into the attrition or pulverising zone by the carrying air.

In the pulverising zone the coal particles are kept in a state of violent agitation until they have been reduced by attrition to a predetermined fineness. This is effected by the intense turbulence caused by a series of large impellers mounted on the rotor. Fixed pegs or interruptors assist in creating this turbulence and also prevent the dust-cloud revolving with the rotor.

When the coal particles have become fine they are drawn by the fan towards the centre, where they must pass a rejector before being blown into the furnace. The

Atritor Coal Pulveriser at the St. Denis Power Station, Paris.

rejector consists of one or more spoon-shaped arms revolving with the rotor; the number of these arms governs the size of the particles delivered by the plant; the coarser particles are intercepted by the rejector and returned to the attrition zone while the finer particles pass to the burner.

During pulverisation the coal is dried by a supply of hot air which is drawn through a duct from the furnace and passes through the plant with the coal.

The machine can be opened up and the rotor removed in less than fifteen minutes; the substitution of a replace rotor and new pegs is therefore a very simple matter. The segments and pegs are made of an alloy cast iron known as Atrinard. Before adopting this material exhaustive experiments were made to determine what metal would offer the greatest resistance to the abrasive action due to the impact of the coal particles, while possessing the necessary strength. Among the many materials tried, white cast iron served to offer the best basis for further experiment, and additions of nickel and chromium gave promising results. When the right proportion of these elements was finally found, the iron gave results twice as good as the ordinary white iron. This Atrinard cast iron is of the Ni-Hard type, which has proved so successful for resisting abrasion in other engineering fields.

Pulverised coal is now being used successfully in the firing of water-tube and Lancashire boilers, rotary cement kilns, metallurgical furnaces of all kinds, and brick and tile ovens. (From the *Nickel Bulletin*.)

STEAM

By

A WHOLE BOOK could be written about the savings in steam that can be effected by correct steam trapping in the Food Industry.

Perhaps three examples can be taken to illustrate the point.

Return of Condensate

It is commonly believed that many types of food preparation plant cannot be steam trapped without slowing down the plant, with consequent loss of production and sometimes spoilage of material. Consequently condensate is run through an orifice or cracked valve on the outlet from the plant and is often put down the drain. If this condensate *could* be saved and returned to the boiler feed tank, the following little sum indicates the saving.

The following example may be given:

Assume steam at 60 lbs. pressure. If no condensate is saved, then boiler feed water is at about 60° F. If condensate is saved, then boiler feed water may be about 150° F. In every pound of water saved there is a saving of 90 heat units. In steam at 60 lbs. pressure there are 897 useful heat units.

The saving possible is therefore about 10 per cent. This is a conservative figure because it takes no account of the saving in the cost of water, and the fact that distilled water is being fed to the boiler.

Nearly every engineer knows the saving of returning condensate, but not everyone knows that the fitting of steam traps to his plant will, for example, enable condensate to be lifted if the feed tank is at a higher level. Many engineers, as we have said before, believe that steam traps slow up production.

Trapping Steam-jacketed Pans

Steam-jacketed pans are far too often untrapped because of this fear of driving up.

A few actual facts will disprove this. Tests were made on a 100-gallon boiling pan. Condensate was allowed to blow through a $\frac{3}{8}$-in. valve. The pan boiled in 24 minutes. The steam consumption was 214 lbs. The outlet was throttled to a $\frac{1}{8}$-in. diameter orifice. The pan boiled in 31 minutes, but the steam consumption was reduced to 189 lbs.

A suitable steam trap was fitted on the outlet. The pan boiled in 28 minutes, and the steam consumption was further reduced to 178 lbs.

ECONOMY
Correct Steam Trapping

By L. G. Northcroft, B.Sc. (Eng.)
A.M.I.Mech.E.

Now that is not a satisfactory result. It is true that a steam economy of 17 per cent. over the first case and 6 per cent. over the second is considerable, but production was reduced by 17 per cent. and 10 per cent. respectively.

That, we should like to guess, is the answer that most engineers would expect. But it is not the final answer. This increase in boiling time was due to the air binding of the top of the jacket, which was caused by the trap on the outlet. An automatic air release was fitted to the top of the jacket. The same steam trap was fitted, and the following results were obtained. The pan boiled in 18 minutes and the steam consumption was 160 lbs.

These final figures represent a *saving* in production of 25 per cent. and 42 per cent. and a *saving* in steam of 26 per cent. and 15 per cent. respectively.

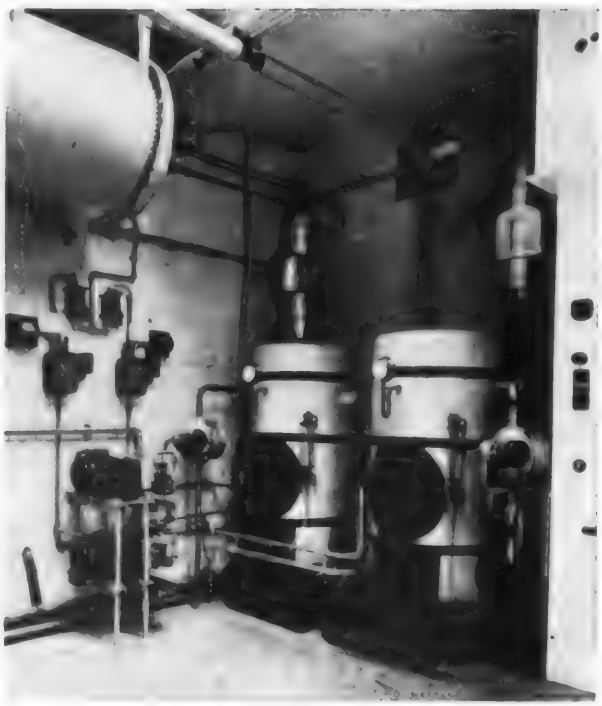
It may be considered a lot of trouble and expense to fit these "gadgets" to a boiling pan, but no responsible person can afford to overlook savings of this nature.

Low Temperature Steam Traps

Boiling pans must have condensate removed as soon as it forms. Only thus can production times be maintained. But the discharge of condensate at steam temperatures is wasteful of heat units. Often it is not necessary. For instance, consider the problem of warming up glucose to make it less viscous. If steam at 60 lbs. pressure is available, condensate is formed at 307° F. There is plenty of heat left in this condensate to do useful warming up work, and there is no need at all to discharge it at this temperature. Steam traps are available (liquid-filled thermostatic traps) which will discharge this condensate after it has given up heat to the glucose and dropped in temperature to 190° F. The saving which may be effected by such correct steam trapping is therefore 117 heat units per pound, or 13 per cent. Perhaps these three typical examples will indicate that there is room for a lot of quiet thought about your steam traps.

On the left are shown Spirax traps fitted on jam boiling-pans at the Mid-Sussex Preserving Co., Ltd.
(*Courtesy of Walker Crosweller and Co., Ltd.*)

GAS IN THE FOOD



Automatic gas steam boilers used by the Express Dairy Company.

GAS IS extensively used in the baking industry, and it is claimed for it that it is clean, reliable; that gas firing is so simple that faults seldom occur; and that should anything go wrong the whole strength of the organisation of the gas industry is at the disposal of the baker. The heat is easily controlled to give even baking all over the oven; the solid fuel store, and consequently dirt, is eliminated; and the oven may be lighted up automatically by clock, which gives the baker some additional hours in bed.

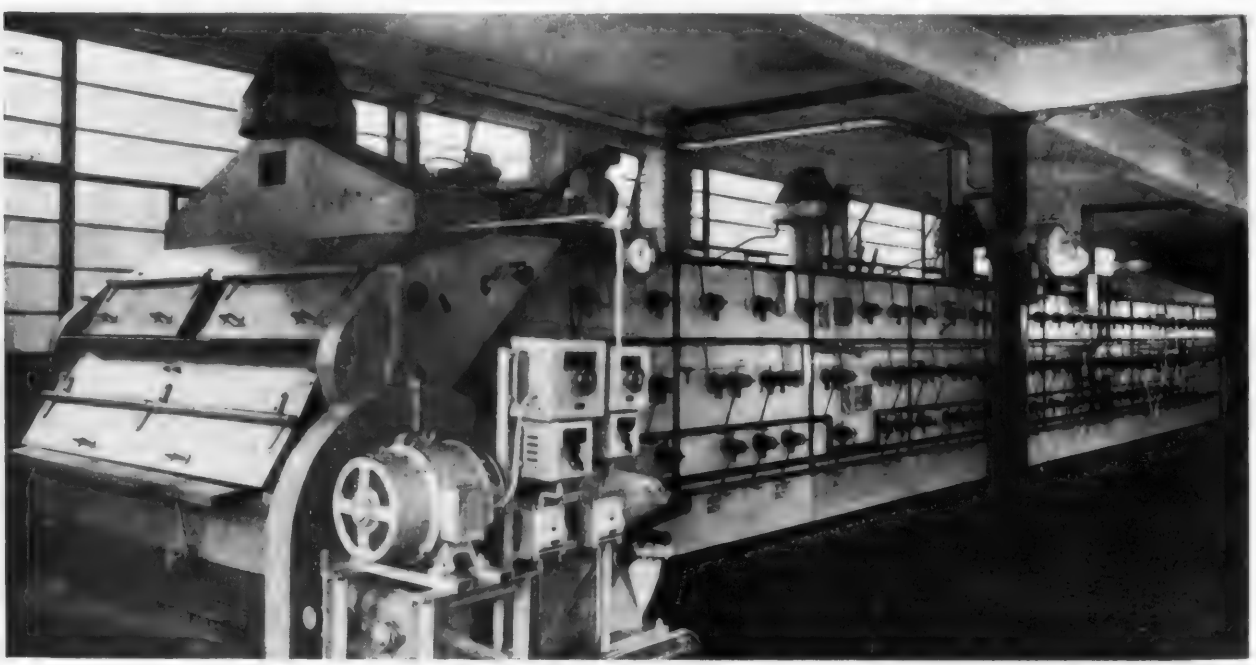
An interesting example of the adoption of gas in the baking industry is where side-flue ovens, hitherto burning coke, are converted to use gas. The conversion is carried out simply and cheaply and the equipment is standardised.

In bakeries where space is a consideration the advantage of bringing in the area occupied by the coke store is evident. The cockroach plague is alleviated by the elimination of the coke store.

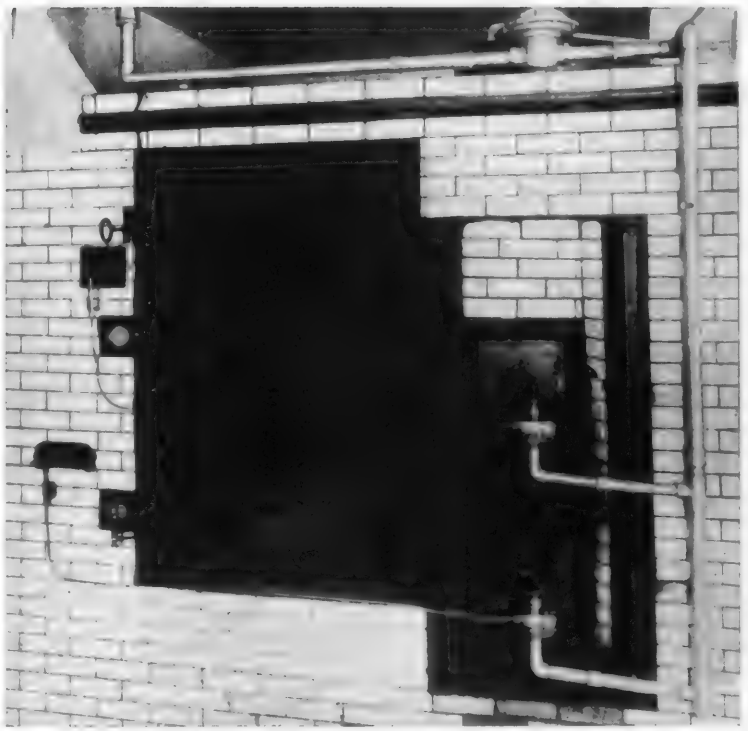
There are some gas undertakings who are willing to undertake the installation of gas in these cases, payment being made by means of a two-part contract embodying easy payments—a valuable aid to the smaller bakers.

Another item which has been taken up by some of the small bakeries is the hot-air oven, which is sometimes preferred to the steam-tube oven. More especially for the

A modern high pressure gas-fired bread baking oven by Baker Perkins, Ltd.



INDUSTRY



Double deck side-flue oven converted from solid fuel firing to gas. Each gas cock is provided with a double safety device, so that the burner cannot be lighted until the bye-pass is on and the damper out. It is often not practicable for a baker to scrap an existing side-flue oven and instal a more modern type. By means of the conversion set shown, however, bakers are enabled to have many of the advantages of gas firing, without the large outlay involved with a new oven. Some gas undertakings include the conversion in the standing charge of their two-part tariff for bakers. (*This and the other pictures in this article are by courtesy of the British Commercial Gas Association.*)

preparation of Vienna bread, a therm spray boiler is fitted. This supplies a mixture of steam and water, which ensures a humid atmosphere during baking.

Other outstanding examples of gas-fired bakers' ovens are the steam-tube oven, draw-plate oven and travelling oven with high pressure gas burners, and biscuit ovens.

Potato Crisps

A very large firm of potato crisp manufacturers use gas for frying their potatoes. It is claimed that the high rate of heat input necessary for cooking crisps renders the use of gas particularly appropriate to the operations concerned. Other advantages are that no contamination of the oil is possible, the source of heat is reliable, fuel economy is possible and the heat is easily controlled.

Sugar Boiling

Many sugar boilers make use of gas as a source of heat, and the advantages are very much the same as in the case of potato crisps.

Milk bottle sterilising cabinet with independent gas-fired steam boiler.

An installation of gas-heated pans for the manufacture of Smith's Crisps.

ELECTRICITY

By L. H. Carmalt

ELECTRICITY IS only just beginning to make the headway as a medium for heat application in the food manufacturing industry that it really merits. In the past, electricity has only been regarded as a source of light and power, but food manufacturers are now beginning to realise that it is an extremely efficient heat medium. Bakers were the first to realise this, and there are quite a few electric baking ovens which have been in use for close on twenty years.

It will be appreciated that with electricity the source of heat can be actually applied internally and not externally, as is the case with fuel as a heat medium. This is a very great asset, as it means that the heat can be applied over the whole of the oven, and heat control is also greatly facilitated. Electric baking ovens range from the small cake oven to the large conveyor type.

Bakers, having realised the efficiency of electric baking ovens, have looked round for further application of electricity in their process work; the next article was, of course, the proving cupboard. The proving cupboard has a very gentle heat, and above the heating elements is fitted a small trough of water to obtain the correct humidity.

Next in popularity is the scone plate. It will be appreciated that where a large quantity of scones are being baked on a flat plate, even heating of the plate is essential, as otherwise individual scones have to be turned over and replaced as they are finished, whereas if the heating is even a complete batch can be turned and replaced at the same time. This adds to efficiency; and a much better coloured scone is obtained.

Bakeries need hot water instantly available, and the electric storage water heater, which is thermostatically controlled, maintains the required quantity of water at the right temperature throughout the whole baking day without any attention whatsoever.

The storage water heater is also used for supplying hot water to the *bain-marie*, which is merely a warm-water well for keeping fillings and flavourings at the correct temperature. The baker and the confectioner have found electricity extremely suitable for couverture work. The baker has the chocolate depositor, which consists of a travelling belt passing under an electrically heated container, which automatically maintains the chocolate at the correct temperature.

Advantages of Electricity

The advantages of electricity are obvious, as firstly there is a common source of motive power and heat, and secondly the heat control is automatic. Only one skilled and two unskilled operators are needed to operate these machines, which are capable of an output varying from 600 large to 2,000 small cakes per hour. The skilled operator stands by the depositor and adjusts the flow of chocolate according to the thickness of covering required.

Electricity is also becoming extremely popular for doughnut frying, fryers for which range from small single-pan units measuring about 20 in. by 20 in. by 18 in. high, which stand on a table, to the large doughnut machine which automatically shapes, fries, and delivers the doughnuts complete.

As electricity is suitable for doughnut frying, it is obvious that it is also suitable for fish and potato frying, and the fish trade is now proving to be very interested indeed in frying by electricity. Electric fish fryers have been in use in restaurant and similar kitchens for a very considerable time, but in such kitchens the speed of frying is not so important, but electric fish ranges are now on the market which compare with any other type. It is absolutely essential for the fried fish and chip shop that the fryer is really speedy in operation, as very large amounts of fried fish and potatoes are supplied over very short periods. There is always the danger with quick frying, however, of burning the oil, and oil is very expensive. With electricity, however, the heat is applied evenly over the whole of the base of the frying pan, and consequently there are no hot spots to burn the oil, and it is more or less up to the operator to see that he reduces the heat when the correct temperature is obtained. The latest models of electric fish ranges are fitted with automatic control, which dispenses with the human element and also saves the operator a considerable amount of time during his very busy rush periods.

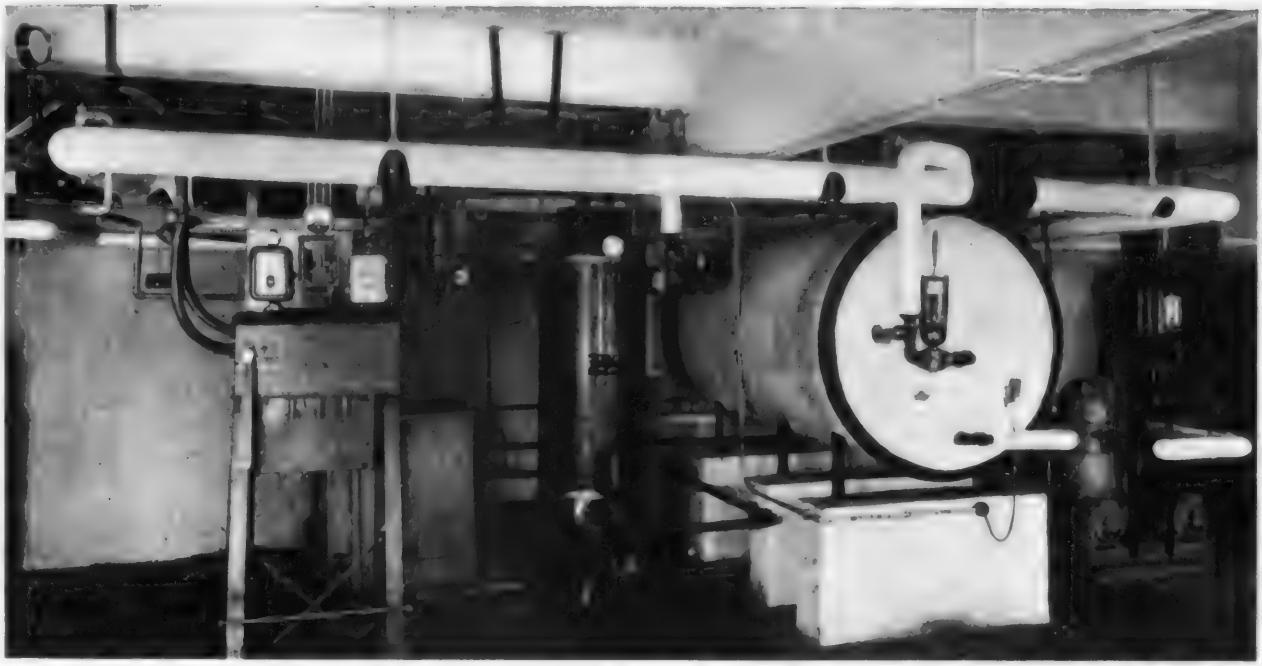
The electric fish range can also be placed in the most suitable position, and several models on the market are now made as part and parcel of the counter over which the fish trader supplies to his customer.

To give an idea of the speed of electric fish fryers, the standard makes available will fry one stone of chipped potatoes per pan in five minutes.

The oil used in these fish ranges is quite expensive, and quite a number of fish traders use an electric fat-rendering machine, which consists of an oil-jacketed container with automatic temperature control, which prevents the possibility of burning. This is a most important point, as if burning is allowed to take place the natural nutritive elements of the fat are spoiled. The standard model clarifier has an output of 160 lbs. of clarified dripping obtained from 185 lbs. of raw fat.

AS A SOURCE OF HEAT

FOR FOOD MANUFACTURERS



(Photograph by courtesy of Bastian and Allen, Ltd.)

The electric boiler-house of Wallaces (Sausage Makers) Ltd., of Glasgow. This boiler provides steam for the manufacture of high-class cooked meats and also for building heating.

Canning Trade

Perhaps the best possibility for applying electricity for process work is in the canning trade. Heat is required for warming the building, and also for cooking, and, as the buildings are generally heated by steam and the food cooked in steam-jacketed boiling pans, a large boiler house has been the natural adjunct of every canning factory. A boiler house, however, is expensive to construct, and it has the disadvantage that it cannot always be placed in the most convenient position for supplying both steam to the factory and to the boiling pans. The electric steam raiser, however, can be placed inside the factory in a most central spot, so that pipe runs and radiation losses are reduced to a minimum, with a very great saving in running costs. No operators are required, as the boiler is absolutely automatic in operation, the correct pressure of steam being maintained. Running costs of these steam raisers are reduced to a minimum, firstly because the boiler space required is very small, secondly no operators are required, thirdly no fuel storage and refuse space is necessary, and fourthly the majority of supply companies offer extremely attractive tariffs owing to the fact that the electricity for raising the steam is taken during "off-peak" hours; in other words, during the time the Electricity Supply Station most requires consumption of electricity. In some cases it is found advisable to have a separate steam raiser for the cooking appliances, as when one boiler is in use for supplying steam for both warming the building and for the cooking appliances electricity has to be taken for boost purposes during the daytime, when the price of current quoted by the supply company will not be so economical. Where a separate electric steam raiser is used for the cooking appliances it is provided with a time-switch control, which is set to switch on the electricity at a set time in the morning so that the correct pressure of steam is available a few minutes before the operators commence work. The pressure is then automatically maintained until it is switched off by the time switch at the end of the working day.

The same sort of equipment is required for the brewery where steam is used for boiling wort. Wort is run in a vat at a temperature of 140° F., and then has to be brought and maintained at the boil for a period.

(*Photograph by courtesy of Bastian and Allen, Ltd.*)

An electric steam boiler supplying steam to the sterilising chest.

The Brewery

Another application of electrical heat in the brewery, but in rather a different way, is the drying of silos before filling them with grain. It is obviously necessary that the silos should be as dry as possible before being filled with grain, and in the past the drying problem was a constant source of worry. The method now employed in one factory is to lower radiant panel elements, similar to those used in an electric fire, into the silo by means of a pulley block, and portions of the silo are dried at a time.

Electric boilers and steam raisers are also used for bottle washing, but after washing it is necessary in some cases for the bottles to be thoroughly dried, and an electric drying oven has been found extremely suitable for this purpose, owing to the fact that electric heat does not contain moisture, whereas, of course, gas heating involves the production of a considerable amount of moisture.

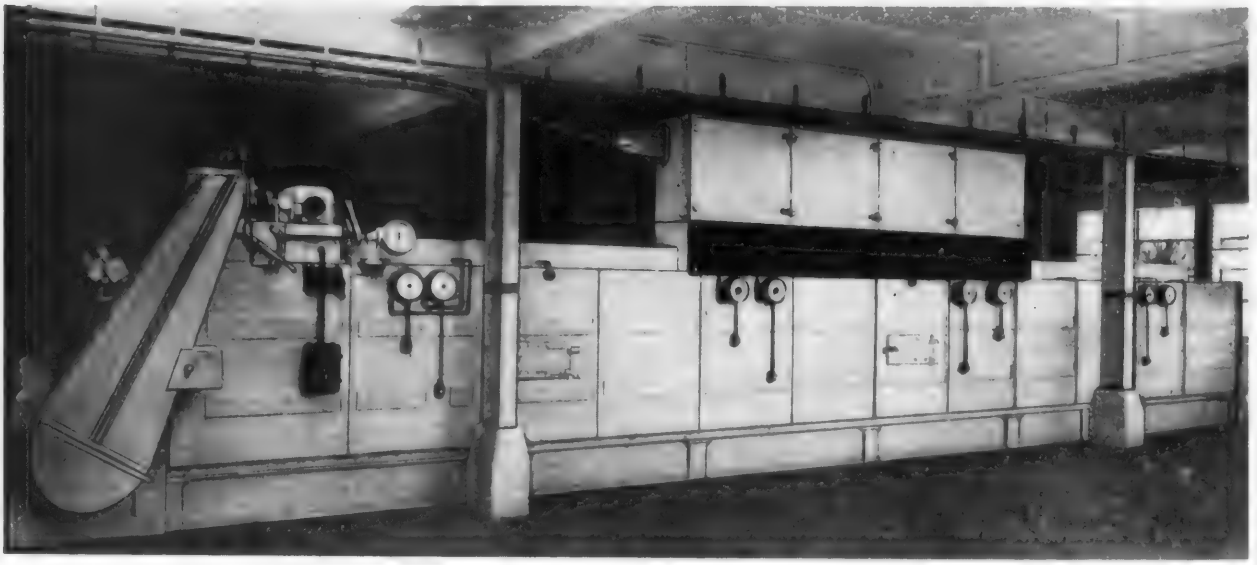
The small trader, such as the one-man cooked meat shop concern, cannot go to the expense of installing steam-jacketed boiling pans, and in the past he has used galvanised containers heated by fuel, the heat being applied to the base of the container, but the inconvenience of these containers was found to be considerable, as burning was very apt to take place owing to the viscous nature of the contents. The electrically equipped boiler is heated by means of immersion heaters, which are inserted into a small water well in the base of the container. This well is kept fairly clear by means of a perforated tray fitted above the heaters. If the container is cleaned frequently, the elements will last a long time, as also will the containers themselves, as no burning of the base or any part of the container takes place. Furthermore, a much greater heat output can be obtained with the electrically heated boiler, owing to the fact that there is no fear of burning.

In some cases electricity has been applied in exactly the same way as fuel, as, for instance, the electrically heated coffee roasting machine, in which a drum is rotated around a heated tube running through the centre. It is obvious that it is much easier to apply electrical heat to the centre of a rotating article than fuel heat.

The foregoing is an attempt to illustrate a few examples of forms of heating by electricity, but no doubt many other applications will suggest themselves to the food manufacturer.

To conclude, the food manufacturer is, naturally, mainly concerned with the running costs of all this process work. It is sufficient to say that the majority of Electric Supply Companies nowadays offer economical tariffs for supplying electricity for heating purposes owing to the fact that nine times out of ten it is an extremely satisfactory load to their supply station.

An electric travelling oven by the General Electric Co., Ltd., installed at the factory of Oliver and Gurden, Ltd., of Oxford.



LIQUID FUEL in the Food Industry

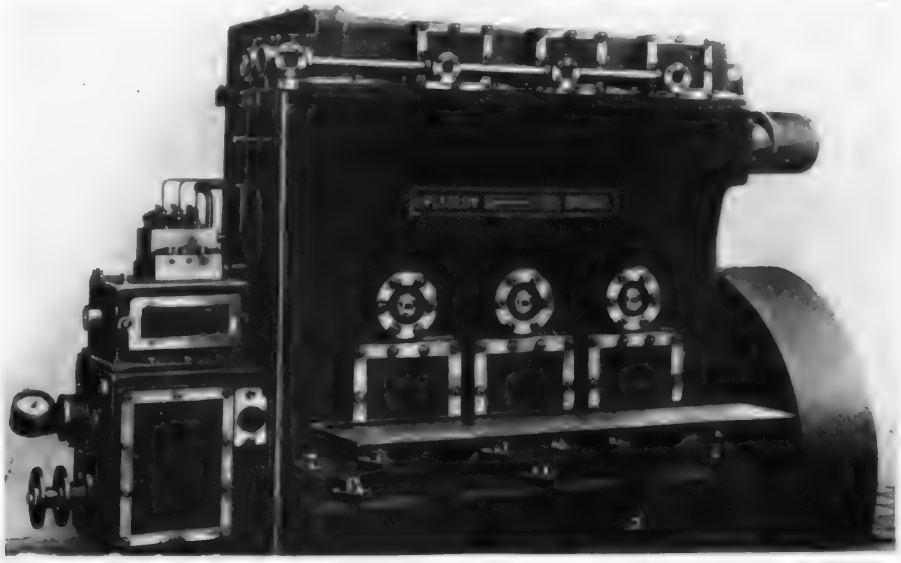
Above are shown Wallsend low air pressure burners applied to steam-tube ovens and boiler, and below a Crossley 3-cylinder vertical oil engine.

THE USE of fuel oil appeals strongly to manufacturers of edible products for the following reasons.

If a modern automatic oil-burning equipment is installed on the central-heating boilers or steam-raising boilers used for process work, the oil suppliers fill the storage tanks and the oil is then automatically fed to the boilers in just the required quantity to maintain the desired boiler temperature or steam pressure.

The oil is efficiently consumed in the firebox of the boiler and leaves no residue in the form of ash or clinker. Thus labour costs in connection with the boiler plant are reduced to a minimum, which is rather important in factories staffed largely with female labour.

With a properly designed oil-burning plant there is an entire absence of dirt, smoke or dust, and perfect cleanliness is obtained in the boiler house and surrounding premises.



Many of the leading manufacturers of British oil burners now produce burners of the fully automatic or semi-automatic types designed to burn the cheapest and heaviest grades of fuel oil, and with these systems most of the advantages of gas or electricity can be obtained at an average equivalent cost of 3d. per therm or 0·1d. per unit. It is not surprising, therefore, that oil has become so popular in food factories, bakeries, etc. A large number of bakers' ovens and biscuit ovens are arranged for oil firing, and those who have not visited a modern bakery with oil-fired ovens would be agreeably surprised at the degree of cleanliness obtained and the accurate temperature control which results from the fitting of oil burners.

Fuel costs on bakers' ovens vary considerably according to the design of ovens and the type and quantity of goods being produced, but there are a number of bakeries in the country using heavy fuel oil and obtaining all its advantages at a fuel cost of 6d. per sack or less.

Although some years ago a fair percentage of the oil burners used in this country were imported, mostly from the U.S.A., practically all oil-burning equipment now used in this country is of entirely British manufacture, and most of the members of the industry belong to the British Oil Burner Manufacturers' Association and supply efficient and up-to-date equipment conforming to the standards laid down by that Association.

The Testing of FUEL

FULL DETAILS on coal appear in a schedule issued by the Board of Trade and reproduced in Bulletin No. 2 of the Lancashire and Cheshire Coal Research Association.

A valuable report on the sampling of small fuel up to 3 ins. is published by the British Standard Engineering Specification No. 403, 1930.

Proximate Analysis of Coal

The methods of determination of moisture, volatile matter and ash are described in the British Standard Engineering Specification No. 403. The interpretation of proximate analysis, as the other details on fuel testing in this article, are to be found in Dr. Godfrey W. Himus's book on *Fuel Testing*.

The Ambler Gas Analysis apparatus.
(Courtesy of A. Gallenkamp and Co., Ltd.)

The Caking Power

The suitability of a coal for specific industrial uses is determined largely by the nature of the solid residue which it leaves on carbonisation; thus, a coal which gives an incoherent or very weakly caked residue is obviously unsuited for the manufacture of metallurgical coke, while on the other hand, coals which give strong and non-porous cokes are not satisfactory for boiler-firing or gas-producer operations. The caking index is expressed as a maximum weight of sand which could be bound into a solid button of coke by 1 gram of coal, both coal and sand being ground to definite sizes. The reader is referred to *Fuel Testing* for a full description of this method.

The Ultimate Analysis of Coal

The electric combustion furnace for carbon and hydrogen is a very convenient apparatus for the determination of carbon and hydrogen. Nitrogen is determined by the Kjeldahl method. The method for sulphur determination is contained in the British Standard Engineering Specification No. 420.

It is sometimes necessary to estimate arsenic in coal, more particularly when the combustion gases may come into contact with food products. This determination is done by the Gutzeit method.

Calorific Value

This is done either by direct or indirect methods. By the direct method the combustion must be complete, which liberates heat which is absorbed in a known weight of water, the rise in temperature of which is a measure of the heat absorbed.

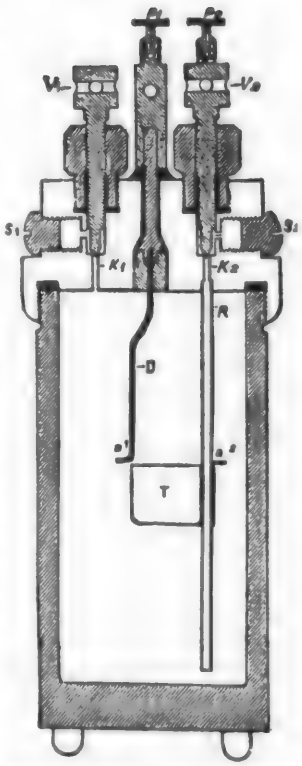
There are many types of calorimeters which are used for the determination of calorific value, the various virtues of which space does not allow us to enumerate.

The indirect methods are attempts to correlate the heating value of a coal with either the ultimate or the proximate composition. Owing to the present imperfect state of our knowledge of the nature of the coal substance and the constitution of the various bodies which go to make up the different classes of coal, it is not surprising that the degree of accuracy of such indirect methods of calorific value determination is low. Dr. Himus discusses several formulæ and their limitations in his book.

Mineral Matter

The mineral matter of coal consists of "dirt" partings of shale or clay, of films and concretions of the carbonates of iron, lime and magnesia, of sulphide of iron (FeS_2) in the forms of pyrites or marcasite, and of sulphate of lime in the form of gypsum. When coal is burnt, the inorganic material is left in a more or less modified state in the form of ash, whose colour and composition vary greatly.

Dr. Himus discusses the advantages accruing from coal cleaning and also washability tests.



The Kroeker modification of the Berthelot-Mahler Bomb. *(By courtesy of A. Gallenkamp and Co., Ltd.)*

The analysis of coal ash is carried out by the routine methods of inorganic analysis.

Mineral matter in coal used for furnace purposes may be objectionable not only by reason of its amount but even more so on account of its properties. It is sometimes necessary to reject a low-ash coal which is otherwise suitable for the purpose in view on account of the easy fusibility of the ash, and to substitute for it a coal carrying a much higher percentage of mineral matter, which leaves in the furnace a residue which shows little or no clinkering propensity. A low-melting ash gives rise to trouble and loss in various ways. Due to these troubles, it is therefore apparent that a laboratory test is required which shall enable the clinkering propensities of coal to be predicted.

A method of the determination of the fusion point of coal ash is given in Fuel Research Technical Paper No. 23 and is also given in Dr. Himus's book.

Gas Analysis

The problems in gas analysis which confront the fuel chemist are, broadly:

1. The analysis of fuel gases.
2. The analysis of combustion products.

Gas analysis has a very extensive literature, and for a detailed examination of the subject Dr. Lunge's *Technical Gas Analysis* still appears to be the standard work on the subject.

The Analysis of Fuel Oil

The analysis of fuel oils is undertaken in relation to fuel supplied under a definite specification as to quality. The main items are:

Specific gravity.
Flash point.
Viscosity.
Calorific value.
Sulphur.
Moisture.
Ash.

Technical Pyrometry

The main examples of the instruments used in technical pyrometry are:

Mercury-in-glass thermometers.
Distance thermometers.
Thermo-electric pyrometers.
Resistance pyrometers.
Optical pyrometers.
Total radiation pyrometers.
Fusion pyrometers.

Fuel Research

(Continued from page 128)

the coal seams in the coalfields of the country were in the course of investigation. The progress might be judged from the fact that up to the present it was computed that between twenty-five and thirty thousand million tons of coal had been surveyed.

The method employed in the Coal Survey was to cut a complete section from the coal seam at a sufficient number of points in the coal area so that every variation in the coal was recorded. Where the seams showed large or sudden variations in properties throughout the coal area it was necessary to obtain a greater number of seam sections than where the variations were slight and regular. It had been found in a number of the coalfields that when the results of the investigation in the laboratory were plotted upon the map of the coalfield, lines of equal properties could be drawn, resembling in some measure the meteorological charts showing lines of equal pressure. Thus it was possible to make charts showing lines of equal volatile matter or equal amounts of tar throughout the coalfield. The data thus obtained showed accurately the changes in properties of the coal in different areas and was of value both to the producer and the consumer. Broadly speaking, it was becoming possible to indicate accurately sources of coal possessing special characteristics which may be required by industry, and at the same time it was indicating to the producer how he could fulfil the special requirements of the consumer.

The Survey also investigates the commercial grades of coal produced by the collieries, as in most collieries two or more seams are worked and blended together.

The Survey had shown how new uses could be found for certain types of coal and at the same time it indicated the presence of constituents which were advantageous for certain purposes and might be of disadvantage for other purposes. With increased precision in the methods of utilising coal, the knowledge being gained by the Survey was being used to an increasing extent by industry.

Abstract from a lecture by Dr. Sinnatt before the Association of Scientific Workers, on March 17.

FUEL RESEARCH

By Dr. F. S. SINNATT, F.R.S.

One of the Fuel Research Coal Survey Laboratories.

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THE PROGRAMME of fuel research must be considered in two parts: the first was concerned with the physical and chemical survey of the coal seams of the country; the second part of the programme was concerned with large-scale work and the exploration of all general methods of utilising the coal. The second programme included the investigation of the mechanical properties of coal so as to be able to obtain coal of suitable sizes, the cleaning of coal by wet and dry methods, the carbonisation of coal at high temperatures and the complete gasification of coal with a view to producing gas suitable for use for industrial purposes, and for the synthesis of liquid hydrocarbons, the low temperature carbonisation of coal, the study of hydrogenation, the conversion of coal into liquid hydrocarbons by synthesis and the combustion of coal in pulverised form. In addition, work was being carried out at certain Universities upon the constitution of coal and upon the properties of catalysts, etc.

The Fuel Research Coal Survey was unique, and as no experience was available on which to base the organisation, its development had necessarily been slow during the first five or six years. It was necessary to study and review the way in which the whole of the coal seams of the country could be surveyed, and it has been finally found that it was necessary to have a separate laboratory, completely equipped, in each of the major coalfields.

It was recognised that each of the coalfields had its own commercial and technical problems, and these could only be studied by a staff whose attention was concentrated upon the problems in a particular area. There were now nine laboratories fully equipped in which practically all

(Continued on page 127.)

Analytical laboratory at the Fuel Research Station.

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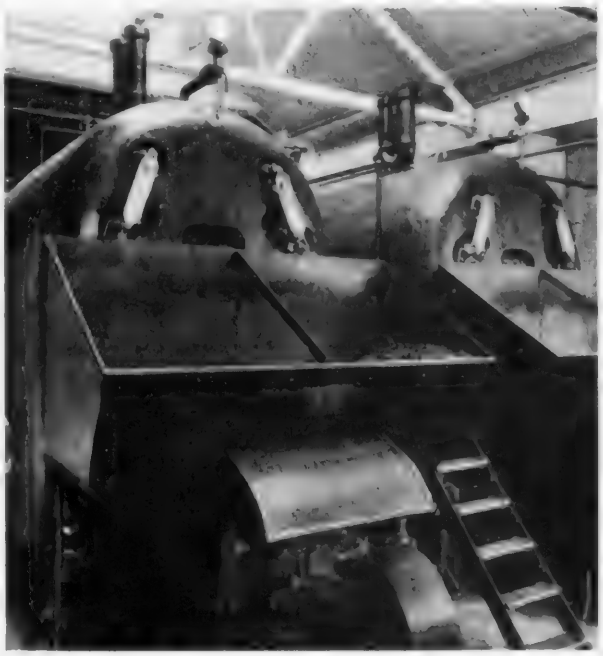
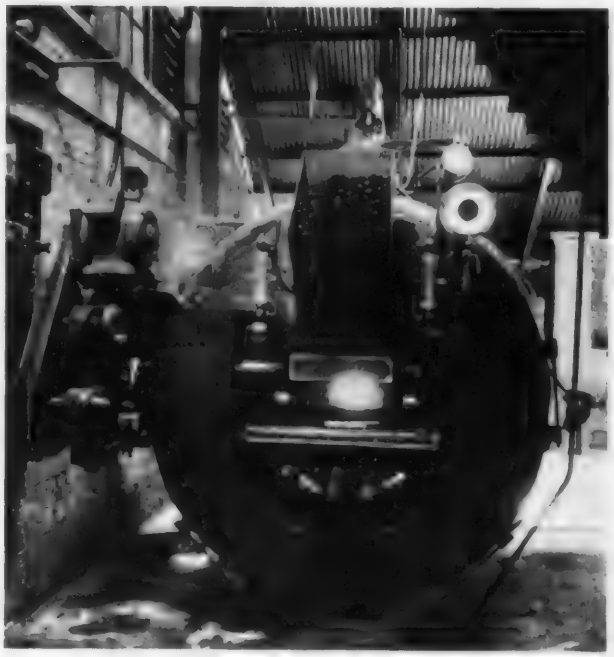
FUEL

PLANT AND MACHINERY



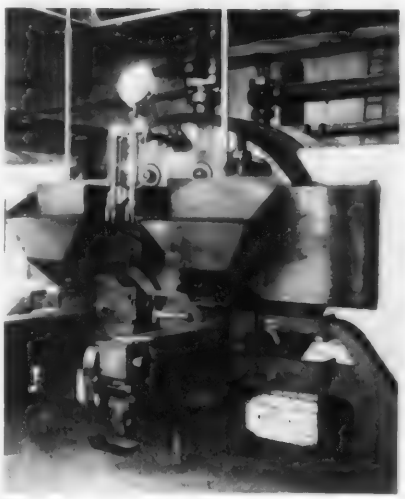
Locomotive multitubular boilers fitted with Riley mechanical stokers. (Marshall Sons and Co., Ltd.)



A super-economic boiler, mechanically fired, made by Danks of Netherton, Ltd., fitted at the flour mills of R. and W. Paul, Ltd.

Doby Stoker Equipment

In each flue is a grate composed of six portions; the part immediately in front of the fuel delivery is a dead-plate and the fuel then passes on to a section known as the primary grate. This has bars of special section, giving maximum air delivery. The other sections of the grate are of 2-in. thick plates, with conical self-cleaning air holes dimensioned and spaced so as to give the correct air delivery required by the fuel as it is pushed beyond the primary grate. Thus the air supply through the fuel is controlled over the whole area to give optimum combustion conditions. There is also a secondary air delivery over the fire which is separately controlled by a butterfly damper and is somewhat preheated by passing through a box exposed to the radiant heat of the fire. Both air supplies are derived from the same air trunk which is coupled to a 5-h.p. motor-driven fan for each boiler. A separate motor is provided to drive the fuel ram on each stoker, through a square-threaded screw and a reversing dog-clutch gear arrangement which secures a sequence of strokes, eight short followed by one of full length. The ram is to one side of the boiler flue and this permits clearing out to be done through a fire door beside it. Because of the full control provided on the air supplies, a high CO_2 can be maintained without the formation of CO, and between 11 and 12 per cent. is the normal performance, there being, of course, no discharge of smoke.



Doby stoker equipment.

The records of the plant show that previous to installing the stokers best hard steam coal at 28s. 6d. per ton was being hand-fired. Comparing the first eight months of Doby steam production with the corresponding eight months of the previous year, the same tonnage of factory product was secured in both periods, but about 24 cwt. less of the cheaper fuel was consumed. Thus the saving effected in this initial period covered the capital cost of the Doby stoker.

A coal stoker (the "Masto-stoker," made by Prior Burners Ltd.) applied to a side-flue baker's oven.

Low Air Pressure Oil Burning

The low air pressure system of oil burning has proved itself to be very efficient, simple and reliable, applied to various types of boilers and furnaces.

For small boiler installations for all purposes this system of oil burning is proving very popular, due to its efficiency, simplicity and low initial cost.

Oil is supplied to the burner by gravity and is atomised by air at a pressure varying from about 8- to 20-inch water gauge, according to circumstances.

The atomising air is supplied by a blower usually driven by an electric motor, so that, provided electric current is available, the burner can be put into operation at any time without the use of special lighting-up appliances.

Only a fraction of the air required for combustion is supplied by the blower, the rest being taken into the furnace through the air director, so that very little power is absorbed by the motor.

An electric heater is for use when raising steam and using a quality of fuel oil which will not burn without being heated. This heater is automatically controlled so as to maintain the oil temperature at the desired level. Once steam is raised the steam line heater is generally used if the oil requires heating.

An idea of the efficiency and flexibility of this system of oil firing is given by the test results shown below, which speak for themselves.

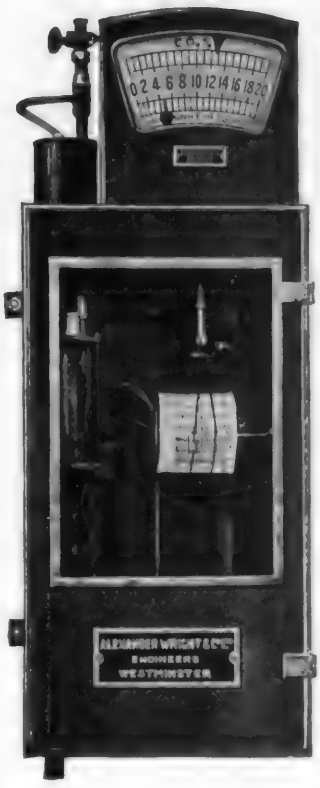
The burners can each be regulated to work at only 20 per cent. of their full load capacity.

Trials

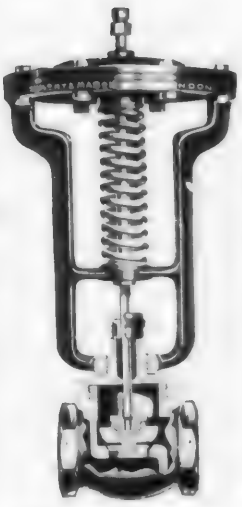
Summary of evaporation trials, each of four hours duration, carried out with the Wallsend Low Air Pressure System of Oil Burning on a Cochran Boiler, Cochran and Co., Ltd., Annan. Boiler 4 ft. 6 ins. diameter by 11 ft. 6 ins. high. Total heating surface, 160 square feet.

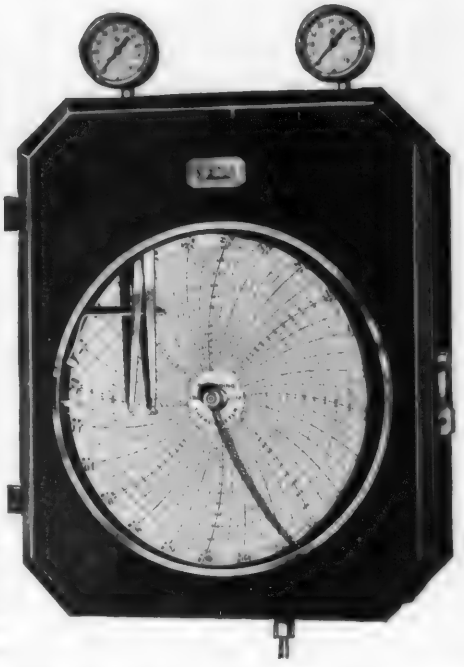
Particulars of Trial.	*Trial No. 1.*	*Trial No. 2.*
Oil temperature in tank	69° F.	77° F.
Oil temperature at burner	143° F.	146° F.
Oil consumed per hour, lbs. ..	128·1	60·75
Water evaporated per hour, lbs. ..	1419	698·5
Water evaporated per sq. ft. H.S...	8·86	4·365
Water evaporated per sq. ft. H.S. from and at 212° F.	10·77	5·3
Boiler gauge pressure, lbs. sq. in...	105	103·6
Temperature of feed water.. ..	48	49·5
Factor of evaporation	1·216	1·214
Lbs. of water per lb. of oil actual..	11·08	11·5
Lbs. of water from and at 212° F...	13·47	13·96
Lbs. of water theoretical (gross) ..	19·25	19·25
Thermal efficiency of boiler (gross)	70%	72·5%
Lbs. of water theoretical (net) ..	18·27	18·27
Thermal efficiency of boiler (net)..	73·8%	76·4%
Air pressure at burner	16" W.G.	13½" W.G.
Air temperature at fan	47° F.	59° F.
Air temperature at burner	171° F.	192° F.
Temperature of atmosphere ..	47° F.	59° F.
Temperature at funnel base ..	700° F.	475° F.
Smoke	Faint trace	Faint trace
CO_2 in flue gases	13·7%	13·7%
Calorific value of oil, B.T.U's. ..	18,679 gross	18,679 gross
Calorific value of oil, B.T.U's. ..	17,723 net	17,723 net
Specific gravity of oil	·95 at 60°	·95 at 60°
Total funnel draught	—⅛"	—⅛"

Boiler stood in an open exposed position and was lagged with fossil meal 1¾ ins. thick. Retarders were fitted in all boiler tubes.



S.A.W. patent CO_2 and draught indicator made by Alex. Wright and Co., Ltd.





Diaphragm valve used in conjunction with "Fulscope" recording controller illustrated on the right. This controller is used for automatic fuel control on the compressed air principle by opening or closing the diaphragm valve according to whether the temperature is above or below a set point. (Short and Mason, Ltd.)

Scientific Control

This aspect of the subject is very rich in various instruments, and it is only possible to mention some typical sets.

Vacuum and pressure indicators and recorders are important items and there are many reliable instruments on the market.

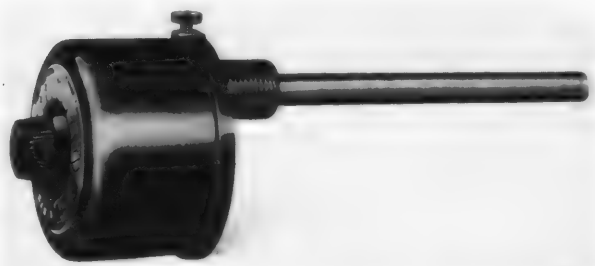
CO_2 and draught recorders are also indispensable adjuncts to fuel-burning equipment, and here again the choice is extensive.

A clean chimney does not necessarily indicate efficient fuel combustion; in fact, it invariably shows that the B.T.U. loss is very considerably greater than it should be. Smoke has been eliminated but only at the expense of fuel economy, for the excess air admitted to reduce or eliminate the smoke carries away with it an enormous amount of heat. Of the two, therefore, a clean chimney may be more wasteful than one emitting quite dense smoke.

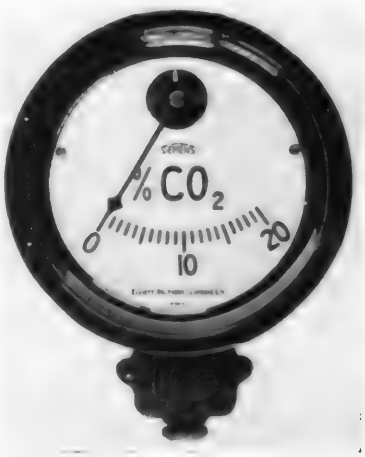
Smoke density indicators have a considerable value in enabling the boiler operator to note the conditions at the chimney from inside the boiler house. It should, of course, be used in conjunction with a CO_2 meter, so that the best CO_2 for the given conditions is maintained, with the minimum of excess air, while a watch is kept on the quality of the chimney emission. Its value is demonstrated, too, during the starting up and changing load periods; and when secondary gas is employed, in adjusting the supplementary air supply to disperse gas pockets, etc.

Thermostats

Instruments designed for operation with Hotwire Vacuum Switches derive their sensitivity from this fact. The control filament of the switch is non-inductive and requires only 25 to 50 milliampères for its operation. As the thermostat has to control only this nominal load, arcing at its contacts is practically non-existent and consequently its time lag and differential may be reduced to a minimum. This thermostat is used for control of temperatures up to 300° C. in industrial processes.

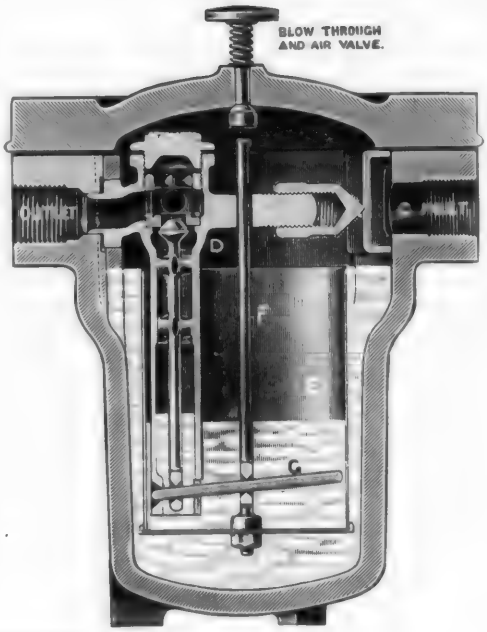


A "Sun-Vic" thermostat as described in the accompanying note.

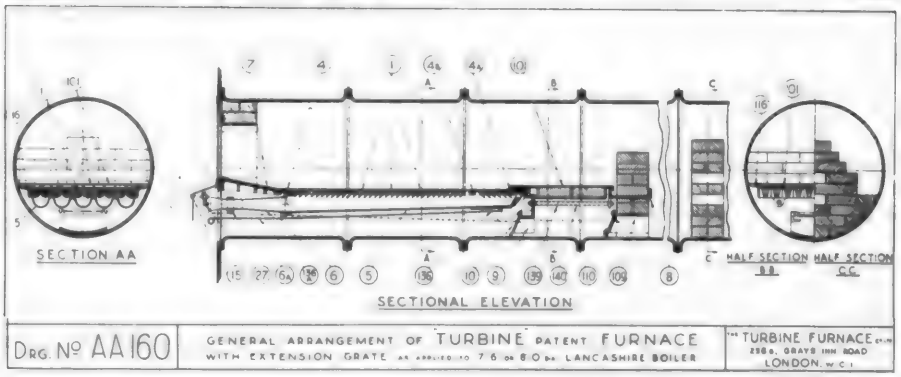


A CO_2 indicator for use with Flue Gas analysis apparatus suitable for use in boiler houses. (Elliot Bros. [London] Limited).

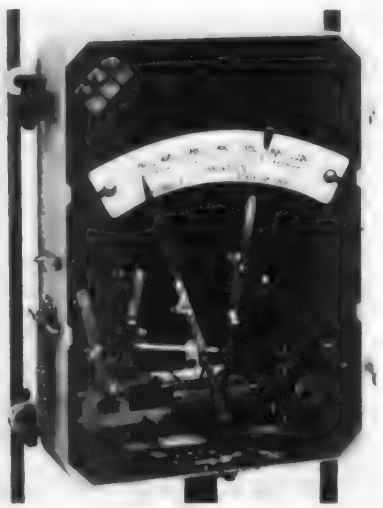
On the left is shown a drop roll machine drive for the actual food processing machinery. It is made by Crofts (Engineers), Ltd.



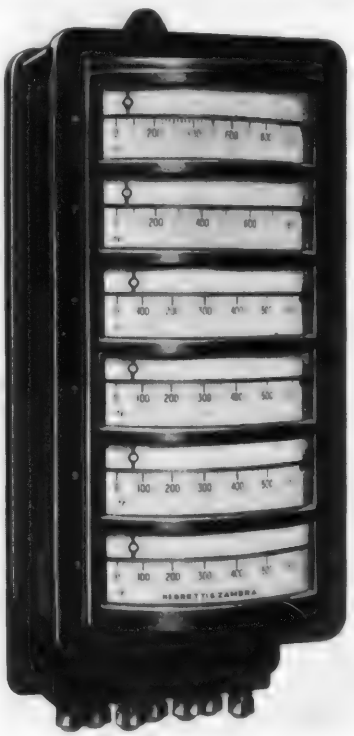
On the right is shown a bucket type steam trap made by Lancaster and Tonge, Ltd.


SECTION AA
SECTIONAL ELEVATION
HALF SECTION BB
HALF SECTION CC
DRG. Nº AA160
GENERAL ARRANGEMENT OF TURBINE PATENT FURNACE WITH EXTENSION GRATE AS APPLIED TO 7'6 OR 8'0 DIA. LANCASHIRE BOILER
"TURBINE FURNACE" CO. LTD. 258 & 259 GRAYS INN ROAD LONDON, W.C.1.

The latest designs of the "Turbine" forced draught furnace for hand or sprinkler stoker firing, using either a fan or steam jets. Generally the latter has the advantages of simplicity and cheapness, with no equipment of any kind other than a small bore steam pipe with control valves and the nozzles, and also no electricity or other external power is required. Steam jets in addition tend to give slightly more efficient combustion in the case of high ash content and low grade coals and also coke, whilst the steam combustion as a rule does not exceed say 2½ per cent. of the boiler evaporation, approximately the same as induced draught.



Bristol's electric indicating controller for operating electric motorised valves used in controlling temperatures of ovens. The front has been cut away to reveal the mechanism.



A multi-point thermocouple pyrometer made by Negretti and Zambra. It is used for reading at one central position various temperatures in connection with boiler plant such as flue gases, steam temperatures, etc.

E. F. Brayham, the well-known statistician, asks the Food Manufacturer . . . . . *DOES YOUR BUSINESS FOLLOW THE LAW OF ORGANIC GROWTH?*

UNTIL RECENTLY, statistics in this country were used only by mathematicians and actuaries with the idea of reducing, on the one hand, figures to graphs and, on the other hand, to portray calculation for easier deduction. To-day, however, the wave has swept widely over the North American continent and Europe, while in the United Kingdom there are not many houses—industrial, commercial or financial—which do not maintain a statistical department.

Visualisation of Data

It is recognised that, in order to absorb data readily, it is imperative to be able to visualise same. Unless one has an extremely retentive memory it is difficult to impress upon the mind's eye trends from figures when uncharted. In the present article I am concerned only with statistics insofar as these bear upon the natural growth of business, the methods adapted for forecasting production or sales, sources available for data bearing upon the Food Industry and graphs used when planning for control of material and progress in manufacturing organisations.

The greatest of all advantages to be derived by the graphical presentation of business data is the fact that charts provide the media for quick action control. By watching the curves portrayed by figures, drops in sales, defects in manufacturing, rises in costs, etc., are readily observed and quickly checked before either one or all regressive factors have had time to ingrain themselves.

Thus we learn from the experience of others that given a continuance of sound management and normal trading conditions, all businesses follow what is described as the law of organic growth. It is just the principle of what is described as the "S" curve. Starting at the bottom of the "S" a business grows gradually until maturity is attained when on the bend of the letter, then it commences to acquire speed and thus attains its temporary zenith at the top of the "S".

At this time one of two things can happen. Either that the management, having grown bankrupt in ideas, have not the will to go beyond its temporary zenith and thus after standing still for a time begins to decline, or the alert Board of Directors having at their disposal all facts charted, persevere in the study of their graphs and thus diagnose the reason for the so-called point of saturation period.

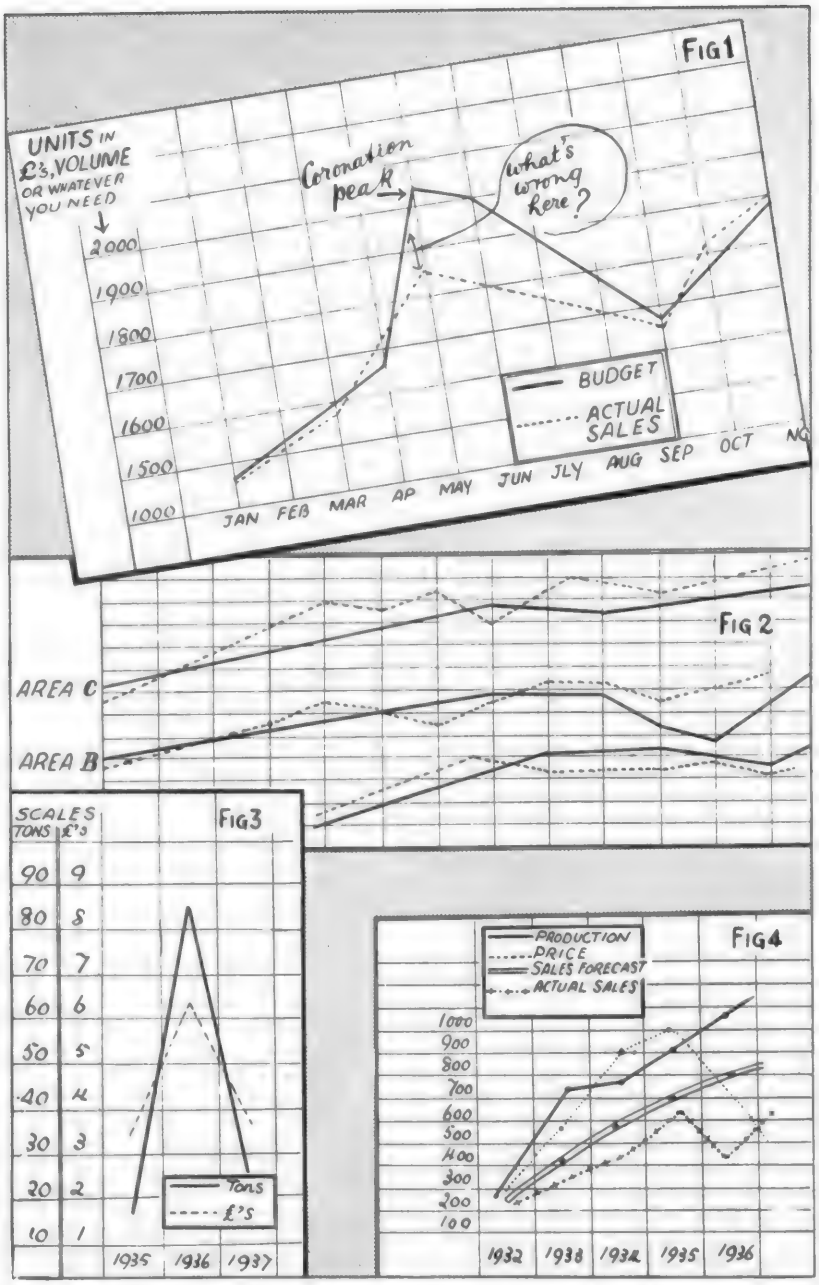
This is the time when the executive has to study its past sales records in conjunction with cost of materials and overheads. Where the percentage of progress has not been commensurate with other factors there is defect. It is, in fact, the time when a "shake-out" is called for so that a new and aggressive production or sales policy be devised to superimpose another "S" upon the first one. And so on.

Output and Sales

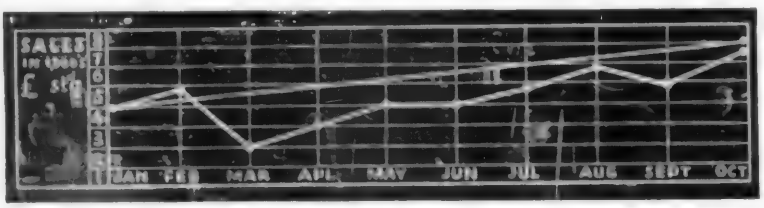
Every business must be planned for output and sales. Take, for instance, Fig. 1. It is assumed that you have been able to get a 12-monthly sales forecast and have plotted the trend line. This chart, of course, will be the "master". You will draw it up on a large sheet for ready observation. On the master chart you plot actual sales figures the moment they are obtainable. In this way you will be able to follow how it fares with your forecast and take immediate action as to whether production should be speeded up or slowed down to avoid high stocks. In this way you get the essential factor in control—speed. On Fig. 2 this idea is carried a step further. Your organisation is divided into areas, countries or continents. You thus prepare a composite chart showing your predicted or budgeted sales against actual sales. This chart could also be adapted where the efforts of each salesman instead of area is to be visualised.

The graphs usually employed in business statistics must be of the utmost simplicity. A complicated chart confuses trends. Fig. 3 shows a chart where value and weight are charted with differing scales, while Fig. 4 gives the varying methods that can be adapted for plotting trends for presenting production and price against predicted and actual sales.

Having prepared the annual or monthly chart, you need to mark the grade represented by the advance.



(Above) FIGS. 1, 2, 3 and 4. (Below) FIG. 5.



This is done by drawing a straight line which joins from end to end of the chart covered by data. It will thus be seen in Fig. 5 that although sales wavered between the months of January and October, yet over this period the trend was definitely upward to the extent of registering a 75 per cent. increase from £4,000 to £7,000.

Forecasting

In explaining the method utilised in forecasting let me quote a set of figures (Fig. 9) culled from a manufacturing company whose graphic records I recently prepared. It would be observed that while the previous year's performance was creditable, this company's sales had declined since 1934 (compared with 1931, 1932, 1933) owing to the increase in cost of raw materials, which in turn necessitated an advance in price of its manufactured article. Although sales volume declined, the profit volume expanded as the management provided a wider spread anticipating further rises in costs of labour and materials, which until now has not offset its expanded margin.

In explaining the opposite charts (Figs. 6, 7, 8) let me state that while I have used single and double lines these could be advantageously substituted with two differently coloured curves. Fig. 6 is roughly the monthly sales charted to show seasonal variations by a thick black line. Across this I have constructed an annual moving average which is obtained by adding the monthly sales and dividing it by twelve (number of months). The result is placed on the spot for the month of July, which is again roughly the true average for this type of business, since seasonal variations are not so pronounced at that time of the year in this line of manufacture.

Trend of Sales

Over a given period you can thus obtain a fairly smooth line which provides the trend of sales between 1931 and 1937. It is advisable when plotting such a chart to use widely spaced (or squared) graph paper in order that the movement be indicated prominently.

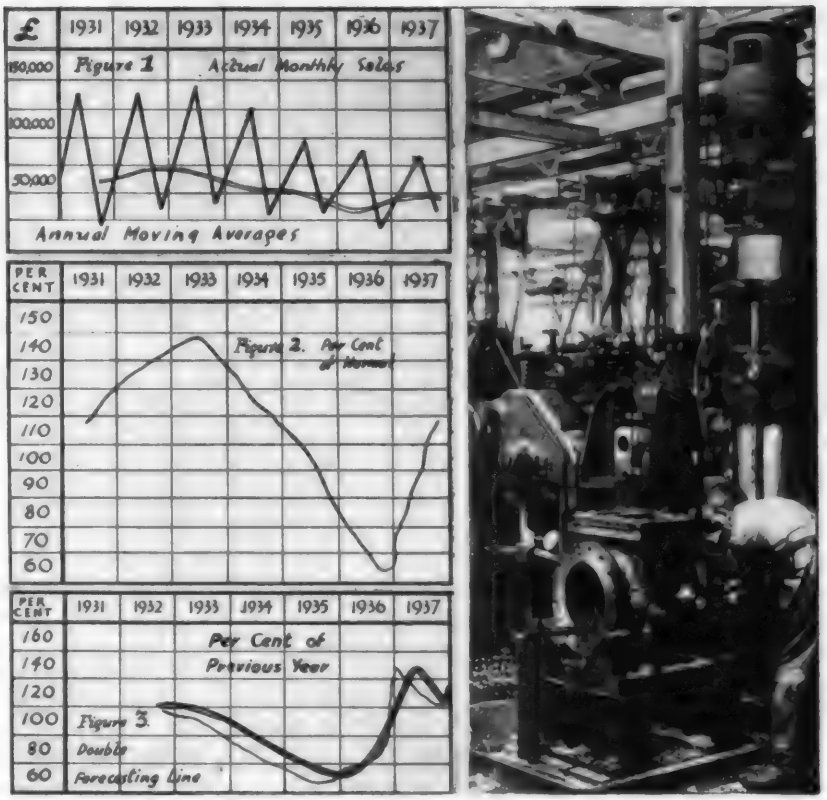
On Fig. 7 I have plotted a line which may be considered to be a "normal" movement for this business. To obtain this curve I have added the annual aggregates and divided this by 84 (the total number of months in the seven years' data provided). The answer is £51,158, which I shall describe here as being "normal per cent." From this answer find the percentages which each

month is of the average normal and plot the result accordingly.

Thus far we have obtained the actual sales against annual moving average and the per cent. normal. The latter shows how the sales have progressed or otherwise when compared with the annual moving average. On Fig. 8 I have traced the percentage of previous year's sales. The double line gives the percentage. To plot this, start with July, 1932, data and divide each moving average figure by the figure for the same month of the previous year. Thus July, 1932, is divided by July, 1931, and so on through to the end. This should give a line which changes its trend somewhat faster than that on Fig. 7, and may therefore be used as the basis for forecasting.

Make any reasonable projection of the line, as shown by the double line, after drawing in a smooth trend line through the "per cent. of previous year" line, making the areas above approximately equal to the areas below.

In making the projection take into account all the factors which influence the situation. Having made this projection, a reasonable estimate of the sales volume for the coming year may be determined, based on knowledge of seasonal trends of the business in question, which in the illustration provided is fairly well marked.



FIGS. 6, 7 and 8.

MONTH	1931	1932	1933	1934	1935	1936	1937
JAN	£ 65000	£ 71000	£ 73000	£ 67000	£ 57000	£ 51000	£ 48000
FEB	74000	83000	85000	82000	74000	60000	57000
MAR	86000	90000	93000	90000	79000	70000	61000
APL	131000	136000	144000	126000	94000	81000	72000
MAY	110000	115000	128000	112000	81000	81000	76000
JNE	97000	108000	111000	98000	74000	45000	89000
JLY	40000	56000	64000	49000	37000	26000	47000
AUG	20000	34000	41000	37000	30000	22000	35000
SEP	27000	34000	38000	32000	26000	18000	37000
OCT	34000	41000	47000	40000	34000	27000	46000
NOV	39000	50000	57000	51000	40000	31000	52000
DEC	56000	61000	66000	52000	42000	36000	57000
TOTAL:	£779000	£879000	£947000	£836000	£668000	£548000	£677000

FIG. 9.

Planning for Control

When planning for control of material and progress in factories, simplicity is more than ever essential, since such charts would have to be handled by workmen whose academic training is limited. Comprehensiveness, too, is vital, since these graphs must concentrate all the essential factors of the production policy, thus enabling the eye to contemplate an entirety rather than a split-up series of data.

There can be but little efficiency in any workshop where the work is not planned, and where you have plans they must be continually visualised as progress is made along the schedule.

Those who served in the Great War will recall the maps provided at divisional and general headquarters which indicated important objects by means of pictorial symbols. For instance, the familiar coffee-pot where refreshment would be available, a black cross indicated a base station, a white cross a rest station, a bursting shell an ammunition dump, and so on. These little symbols were graphic and unmistakably impressive. They put over the information at a glance, calling for no laborious study, for the observer is already familiar with their associations.

In the same way, business charts should be prepared so that figures are made to talk via the simple and comprehensive route.

Imagine, for instance, an attempt to describe by words and figures the work necessary to machine a complicated casting, instead of putting the instructions in the form of a working drawing or blue print, which the average workman can visualise in a fraction of time with far less effort and chance of error.

The usual factory production system is generally made up of an array of forms, figures, compilations and statistical statements which the foremen, departmental managers and executives must take and compare, analyse and then mentally visualise before coming to a conclusion. The aim of graphs is to take these essentials and so picture them as both to stimulate and render less of a task the mental processes that are necessary to form conclusions.

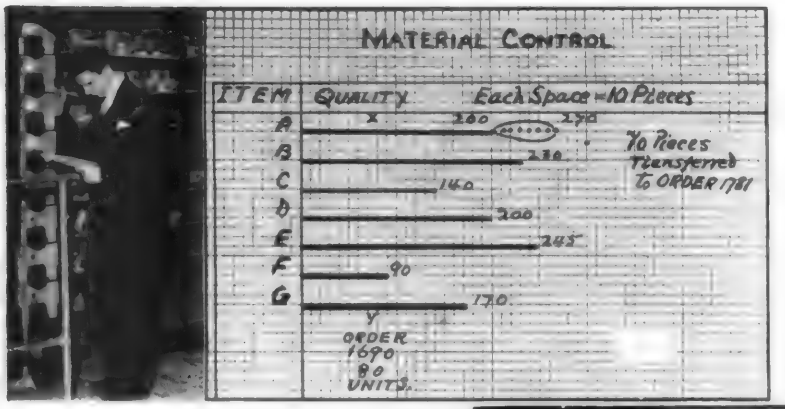


FIG 10.

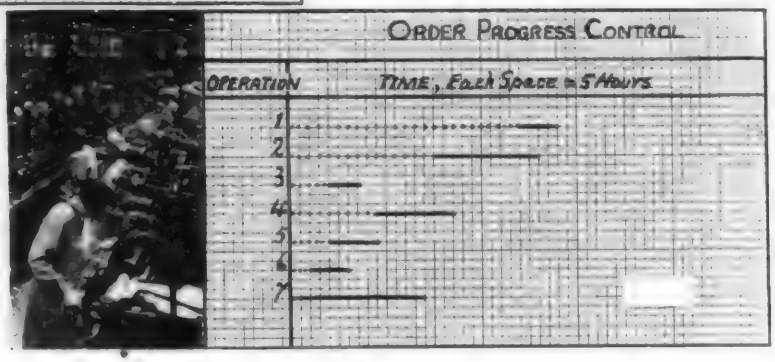


FIG. 11.

Factory Control

Let me illustrate two bearing upon factory control. On Fig. 9 it will be seen that time to be performed is expressed by a straight horizontal line and that the actual line of operations is expressed by the dotted line, the balance being the work still to be done. Reference to the chart will also show how comprehensive and simple the operations are in sequence-hours of standard time taken, hours of actual time, hours still to be performed, and to what extent the standard time exceeds or is exceeded by the actual time. In other words, exact condition of operations is shown at a glance, withal furnishing an excellent means for determining just where to apply pressure.

This last is one of the most valuable features of graphic control. The symbols tell their story so quickly that any appropriate action needed at any point *can be taken at once*. This is in sharp contrast to the long, delayed action, which is the only resort of the management which relies on more complicated documentary types of reports. *Delayed action almost inevitably means a loss of control over that vital factor—costs.*

Turning to Fig 10, we see the component parts of a sub-assembly; reference will show the amounts of each on hand. It will be noted that no more assembly can be done beyond the quantity shown at "F" (90 pieces). This is the limiting material.

The vertical line indicates the material assembled on order 1690, with balances available for assembly shown graphically. It has been found, let us assume, that on order 1781 there is a shortage of 70 pieces in item "A", so 70 pieces are deducted from order 1690 because of the large balance on hand for this item and transferred to the sheet for order 1781, and the quantity (70 pieces) rubbed off the sheet as shown by the dotted line—the entries having been originally made in pencil. To show the exact material situation and the limitations and to arrange for transfers and assembling, nothing could be more simple or graphic.

Now let us revert to Fig. 1. On such a graph you can also chart the predicted or estimated production against actual. The trend line graph (Fig. 5) can also be adapted to show whether the worker, section or department (as the case may be) has progressed over a given period by drawing a straight line, which determines the *tempo* of the fluctuations.

Application to Food

Insofar as food manufacturers are concerned, four key charts relating to cost of raw materials, cost of production wages, administration and profits must be maintained. Moreover, a composite chart showing these four items is imperative for the executive who is destined to watch the law of organic growth or the "S" curve described above.

In the heavy industries, cost of labour varies between 57 and 63 per cent. of turnover, but in the food industries, owing to adoption of a large percentage of unskilled labour, this item is much lower and is variously estimated at between 40 and 50 per cent. Cost of raw materials is higher among food manufacturers, whose averages are between 25 and 40 per cent. against 22 to 30 per cent. of turnover in the heavy industries. Administration expenses are much higher in the food group, since the overhead in selling involves a *corps* of travellers, and this averages between 12 and 17 per cent. against 7 and 9 per

(*Continued on page* 139.)

The Threat to the Jelly Tablet

By E. J. Thomas

[*F.M. photograph.*

IS THE familiar jelly tablet due to be eclipsed; and will its hitherto somewhat apologetic rival, the jelly powder, succeed it? The tablet is so well entrenched in public favour the question might seem frivolous were it not that the powder is apologetic no longer. If the blind eye of complacency has, for just a little too long, been turned to the powder, it is high time the threat it constitutes to the other was honestly faced. The jelly powder has ceased to be a quasi-competitive *idea*; it is a virile, competitive *product*.

Introduction of Jelly Powder

One need not be an ancient in the food industry to have witnessed the introduction of the jelly powder. For a long time it had few features to commend it and was, in many respects, a particularly unhandsome product. Even to-day one can still meet with the powder which has apparently tired of its discontinuous existence and whose discovery by the purchaser is rendered all the more irritating for the unholy reluctance to leave its wrappings it so stickily manifests. Of anæmic appearance, its solubility is as tardy as its set is doubtful and the eventual meeting with the palate dreary. As remarked, one can still meet this type of jelly powder, but so, also, can one encounter the just as unfortunate-looking, clouded and insipid tablet. The truth of the matter is, the jelly powder has not been content to march always in the wake of the tablet. In almost every respect of quality it is now undoubtedly the most dangerous competitor with which the tablet has to deal. The thoughtful manufacturer, especially he whose mainstay is the jelly tablet, may well give thought to whether the tablet is soon to join the company of the numerous "has-beens" of the food industry or not, and whether the powder is to reign triumphant in its stead.

[*F.M. photograph.*

Such a state of affairs is by no means inconceivable. In the United States or Canada or Australia, far from having to compete for an existence with it, the jelly powder is sold to the almost complete exclusion of the tablet. Indeed, it is here submitted that, to a large extent, only conservatism or habit on the part of the buying public can account for the continued favour the tablet enjoys in this country. Let us for a moment excuse the odium with which comparison is usually associated and consider, with as little bias as possible, the more obvious aspects of both products.

Those important qualities such as clarity, freedom from the formerly far too common "meaty"—or worse—flavours, reliability of set and bacteriological cleanliness being inherent in the gelatine can no more be considered the prerogative of the one than of the other product. On the score of solubility, however, the claims of the "pull-apart" and "diced" type of tablets notwithstanding, the powder has a very definite advantage. This is an important consideration from the point of view of the housewife to whom, though it may lack somewhat in other directions, that product whose manipulation is easy is more than half sold. The same aspect, that of solubility, has another feature not always recognised. Most products in these days of careful cost counting are so rigidly formulated that only that much gelatine enters them as will just fulfil the function of providing an adequate physical set to the product. Slow or difficult solution, therefore, particularly in the case of the gelatine, which is the least readily soluble component of the powder or the tablet, is apt to result in incomplete solution at the time of the product's manipulation at the hands of the housewife. Consequently the inevitable failure of the set is viewed by her as an indisputable fault of the product and her regard for it fades. Solubility, then, not only of one or two components, but of the product as a whole, is vital.

To return, however, to the comparison, when considered from the standpoint of the manufacturer, the jelly powder seems unduly fortunate. It costs nothing to cook, its manufacture is accomplished with less personnel and in less time than that required by the tablet. Nor, as a rule, does it cost as much to package, and the final circumstances of its smaller weight and bulk per unit package result in smaller freight and shipping costs.

Handicap of Tablet

On the whole, then, the jelly tablet appears somewhat handicapped for competition, but in all fairness it must be admitted that the blackness of the picture is not wholly unrelieved. The by no means inconsiderable factor noted above, namely that of public preference, makes the balance a more even one, and, in addition, the jelly tablet possesses one quality that so far its rival has barely been able to approach. The twin conditions of the tablet being not only compatible with but demanding liquid in order so to exist; and that this liquid requirement can facilitate the inclusion of those flavouring substances which always function better in a liquid state, permit the tablet to show a marked superiority over the powder in the matter of flavour.

Recognised always as both a particular and a general problem, probably no other aspect of the manufacture of jelly powders has been given as much thought or been the object of as much research as that of the flavouring. Generally speaking, the difficulties encountered have been (and still are) threefold in nature and can be considered as:

(1) The inefficiency and insufficiency of available synthetics.

(2) The tremendous surface represented by the jelly powder in its granular form and the rapid and almost inevitably deleterious alteration to flavouring mixtures this factor causes, and

(3) The inadmissibility, for many reasons, of certain natural flavouring substances—and of fruit juices in particular—in *adequate* amounts.

The first was, and still is, despite the claims of the manufacturers of synthetic flavour, obvious enough.

Flavour

Whatever it be, art or science, the practice of flavouring has not yet reached that delectable point where the imitation is honestly comparable with the natural. Even when an almost comparable mixture of synthetics is transferred to the batch, if, as is more often the case than not, it is to dry upon or into the sugar, apparently every component of it conspires to misbehave. Each with its own boiling-point and consequently due to evaporate at a faster or slower rate; each more or less stable and therefore more or less subject to alteration on the inevitable exposure to atmospheric action; traces of one substance may linger overlong, while others which should remain prominent become so ethereal in every sense of the word as to be lacking altogether. Eventually a very different flavour than that originally compounded is imparted to the batch, and all too frequently the resulting flavour is so devoid of truth of representation and even palatability that its acceptance under any circumstances is a matter of wonder.

Nor is the flavour in the more fortunate position of the perfume which can usually be made more stable by the addition of one or another of a number of fixatives. The choice, for use in foodstuffs, of those substances which might exhibit qualities of fixation in some appreciable degree, is definitely limited. There are few, if any, whose use does not introduce complications such as hygroscopic tendencies or "off"-flavours, of some kind. No, the problem of flavouring foods generally and jelly powders in particular is often only a partially successful juggling of incompatibilities.

Such few lucky instances as those, say, of the citrus flavours are possible exceptions to the general run of partial failures only because, although their shelf-life is pathetically short, while it does last, the flavour imparted by the use of natural oils which are of a more than generally stable nature is passable. As a rule, though, their cost is seriously out of proportion to that of the rest of the batch. For this reason the above-mentioned passable flavour is seldom offered the consumer in anything more than the faintest of identity. Fruit juices which in most cases are excellent flavour-bearing bodies are denied admission—that is, in anything like reasonable amounts—on a number of grounds. Seldom are they free from acid with its deleterious sugar inverting propensities; their price, in view of the necessary processing they must undergo, is usually prohibitive; and seldom, again, are they not so altered in character by the said processing and concentration as to fail to approach the fresh juice in quality of flavour. At best, at present, their most commendable function is to give, no matter by how little, a trifle more permanence to a flavour and a little more truth of representation to the components of it.

Of the numberless attempts to cope with this vexed problem of enhancing the taste of the jelly powder, only a few are worthy of mention as attaining the desirable in some measure. Among these one may be likened to a sort of half-caste product consisting of about three parts jelly powder with which is incorporated the fourth part in the form of a diminutive tablet containing the flavour. Unfortunately, the undoubted advantage thus achieved combines also the manipulative disadvantages of both products—tablet and powder. To the housewife the result is decidedly unhandy.

Much nearer a satisfactory solution is another type of product which is the subject of Canadian Patent No. 1,285,404. In this case the patentees package the usual mixture of granulated sugar and gelatine with what is quite euphemistically and happily termed a "flavour bud". The "bud" is nothing more than the vehicle for the flavour and is composed of sugar and of an unobtrusive size. Except that of course it is not chocolate coated, it is very similar to the familiar liqueur chocolate, in that the flavour, in a liquid condition, is enclosed in a jacket of sugar crystals. The significant feature of it is that it permits the inclusion of fruit juices, volatile synthetics, and natural oils in their more efficient liquid state and almost completely protected from the undesirable action of either light or air.

Along similar lines another approach has been toward the better flavouring of the jelly powder. The essential feature consists of a small wax bottle which is packed in with the sugar-gelatine mixture. The housewife is supposed to add the flavour content of the little bottle to the powder at the time of use. It is, however, obviously no more than a none too successful copy of the "flavour bud" idea. Moreover, it would seem to be condemned on psychological grounds alone—housewives do not take kindly to foreign objects in food products!

A number of dry flavours too have of late years been offered as the solution to the most worrying problem of the jelly powder manufacturer. Consisting usually of sugar—cerelose, as often as not—which has been dried in vacuum with varying amounts of fruit juices, they mostly fail, however, to afford entire satisfaction. Generally the process makes them so costly that their extensive use in as competitive a product as jelly powder is precluded, while physically many of them exhibit a tendency to the hygroscopic which denies their proximity to as moisture-susceptible a substance as gelatine.

The Flavour Bud

Of them all, the "flavour bud" is probably the most successful. But, excellent as it is, it cannot be regarded as the ultimate in the technique of jelly powder flavouring. It does, though, bear indisputable witness to the progress that can be made toward the achievement of the perfect product. Further, if advance can be made from the jelly powder that *was* to the one that *is* to-day, there seems to be ample justification for inferring its further advance to the eventual eclipse of the tablet.

Since, as far as the fabrication of both products goes, the factor of flavour is the last stronghold of the tablet; and since except for this one factor which, it may be surmised, will eventually be met by its rival, it would seem to be only a matter of time before the powder will emerge the superior and more popular product.

The one weapon, then, left to the hand of the tablet whereby it can maintain its present enviable hold on public favour is the denial to the consumer of *motive* for change. In other words, it must never dissatisfy the purchaser. If the motive for change is removed and the not inconsiderable public trait of aversion to change exploited to the full, the tablet should be able to continue in its present popularity for some considerable time to come.

Law of Organic Growth (continued from page 136)

cent. in other industries; but the margin of profits, however, compensates the food manufacturer better, since it is between 6 and 10 per cent. of turnover against 5 and 7 per cent. in the heavy industries.

Taking a *mean average* of the data provided above, the following are the comparisons:

	Food.	*Heavy.*
Cost of labour	45 per cent.	60 per cent.
Raw materials	32·5 ,,	26 ,,
Administration expenses	14·5 ,,	8 ,,
Profits	8 ,,	6 ,,
	100 ,,	100 ,,

Manufacturers of food products and those catering to this industry have a large variety of indices available bearing upon this group. Such official compilations as the cost of living index, wages and commodities are for periodical study, since each of them bears upon individual angles such as marketing price, cost of labour, and cost of raw materials. Board of Trade monthly returns showing export and import trade of the various and kindred items manufactured are invariably helpful, while the League of Nations' monthly bulletins on world trade and the United Kingdom Chamber of Shipping statistics should often be consulted both for checking against information and to study trends in other countries.

Railway companies' goods and passenger weekly reports show concentration and disposal of goods, while the leading joint stock banks' monthly reviews could guide one as to the state of trade in various parts of the country. Each of these reports should be earmarked for quick absorption by the "key" men of every organisation, for each in its turn contributes, piecemeal, its own bit towards the mosaic of one's undertaking.

Book Reviews

Piloting the Food Manufacturer

The 1938 edition of *Food Industries Manual* (Leonard Hill Limited) which first-year readers of FOOD MANUFACTURE and *Food Industries Weekly* are entitled to receive free of cost, maintains, and indeed surpasses, the high standard of previous editions.

Dressed in an attractive grey cover, it justifies its place on the desk of the food executive, and its size, despite the surprising scope of its contents, is such that it may be handled comfortably.

Among its many virtues, the speed with which data may be collated is not one of the least, and is, indeed, one of its most useful features. Suppose a food manufacturer wishes to find out where to buy anything from Abattoir equipment to Zinc Sulphate? The Classified Index will give him the names of the principal suppliers of the commodity he seeks; the Alphabetical Index will give him their postal and telegraphic addresses and telephone numbers. The whole story, in fact, may be found in under two minutes.

Again, how many times are business men at a loss to trace the owners of a certain trade mark? A reference to the Trade Names and Trade Marks Section of the Manual will probably do the needful.

The technical part maintains its usefulness. It is, in effect, a sectionised textbook on food manufacturing methods. Textbooks, however, are not usually revised and brought up to date at such short intervals as twelve months, which is what happens to the Manual. This year, the Dairy Section has been revised and almost completely re-written in the light of the latest information.

All the sections are written by well-known authorities on their subjects and cover Wheat, Milling, Baking, Flour and Sugar Confectionery, Chocolate, Jams, Jellies, Canning, Meat Products, Dairy Industry, Packing, Cold Storage and the Composition of Foods. An up-to-date bibliography completes the work.

The sections are divided alphabetically into their different sub-sections. For example, if a canner wishes to refer to some point about the National Mark he places his finger on the appropriate tab at the edge of the book—"Canning". He then turns to "N" and finds what he seeks. And so through the whole gamut of the food industry.

There is nothing quite like this unique work available to the workers in all branches of the food industry—a veritable *vade mecum*.

W. G.

A Book for the Sugar Producer

A handy volume of facts and figures, useful to those engaged in the production, refining, transportation, purchase or sale of sugar house equipment or supplies, is the 1937 *Sugar Reference Book and Directory*.

This contains the complete official text of the International Sugar Agreement of 1937, and also some valuable articles by experts. Of particular interest is an article by Dr. C. A. Browne on *The Centenary of the Beet Sugar Industry in the United States*. In the preparation of this article the writer has drawn largely upon rare volumes in various libraries.

Statistics of sugar concerns, production, etc., in all the countries of the world are given, and, in short, the work is a compendium of what is going on in the sugar world. It is handsomely illustrated by maps and pictures of cane fields and sugar mills.

A useful directory of equipment manufacturers is included.

W. G.

Sugar Reference Book and Directory. Pp. 184. *London.* 21*s.*

Vitamins Up-to-Date

Of recent years much importance has been attached to the study of the pathological changes associated with vitamin deficiency. Many facts which formerly appeared quite disconnected have thus been correlated. By the study of the influence of vitamin A deficiency upon epithelial tissues, the connection between many of the diverse clinical symptoms has been made clear. The authors have made important contributions to this aspect of the study of vitamins, and have rightly stressed it in their book.

The text is mainly concerned with the chemical nature, function and deficiency diseases associated with the vitamins whose identities are firmly established—namely, A, B_1 and B_2, C, D and E. Theories and facts, gleaned from very diverse sources, of the work done on vitamins over a long period are collected and moulded into a coherent and concise treatise. Research as recent in date as July, 1936, is included, for example, the synthesis of vitamin B_1.

In dealing with the nature of the vitamins, structural and molecular formulæ, probable constituents of the B complex, isomeric forms of ascorbic acid, and stability of vitamins to oxidation, heat and *p*H, are the main subjects treated. In the consideration of the chemical nature of vitamin C, a number of compounds possessing antiscorbutic properties and related to hexuronic acid are called in the text "synthetic forms" of hexuronic acid. This is misleading, as some of these compounds have a seven-carbon-atom chain, and cannot therefore be "forms" of hexuronic acid, which has six carbon atoms only.

The major part of the text is devoted to descriptions of the symptoms, pathology and treatment of deficiency diseases, both in experimental animals and man. These descriptions are illustrated by twenty-seven photographs, including microphotographs. A chapter is devoted to clinical tests assisting diagnosis; as, for example, the measurement of night blindness, capillary resistance, etc.

Although the definite deficiency diseases of rickets, scurvy, beri-beri, etc., in their grosser forms are comparatively rare—at least, in England and America—the authors emphasise that the incidence of a *degree of deficiency* giving rise to subclinical effects is probably quite high. Susceptibility to infection and lesions of epithelial tissues in vitamin A deficiency, vitamin B and gastro-intestinal disturbances, vitamin C and capillary disturbances, vitamin C and capillary fragility are some of the problems discussed in connection with the subclinical stages.

The subject of hypervitaminosis receives attention in the sections on vitamins A and D. The muscle degeneration recorded in animals fed on certain vitamin A concentrates appears to be caused not by the vitamin but by some associated toxic substance. The evidence for the connection between resistance to infection and the vitamins is more substantial in the case of A and C than in the other vitamins. The authors appear to believe that vitamins have no direct antibacterial action, but that in cases where deficiency is present their administration raises the resistance by restoration of normal function of the tissues.

The value of the book is enhanced by a comprehensive table of the vitamin values of foods, expressed in terms of units per gramme. The opinions of the authors upon controversial subjects are obviously derived from a careful and unbiassed sifting of available evidence. This book is an excellent résumé of our present knowledge of vitamins and their associated deficiency diseases, and will, undoubtedly, find wide acceptance in this country as well as in America.

F. G. H.

The Avitaminoses. By W. H. Eddy, Ph.D., and G. Dalldorf, M.D. Pp. 321 *and indices; plates* 29. *London.* 1937. 20*s.*

GENERALITIES

No Copper Colours for Egypt

A notice in the *B.O.T. Journal* states that the Board of Trade have now received a translation of a draft Egyptian law which provides that vegetables and preserved foodstuffs shall not be imported into Egypt unless accompanied by a declaration from a proper authority in the country of export certifying that they are free from sulphate of copper. Goods unaccompanied by the requisite certificate shall be destroyed without compensation unless re-exported within a month. Goods accompanied with the certificate but found to contain copper sulphate may also be destroyed.

* * *

Dutch Margarine in Britain

On page 31 of our January last issue, we announced the proposed formation of a margarine works at Hull by a Dutch company, N. V. Benninga's Friesche Margarine-fabrieken. This concern has now formed a new company with a capital of £50,000 to commence operations at Hull, with the name of Benninga (Hull), Ltd. (see "New Companies" this issue).

The title of the Mitcham branch of Benninga's has also been changed to Benninga (Mitcham), Ltd., in place of the old style of Benninga's British Margarine and Produce Co., Ltd.

* * *

Twentieth-Century Air Conditioning

Mellor, Bromley and Co., Ltd., of Minotaur Works, Leicester, have issued a well-produced catalogue showing their air-conditioning plant suitable for all purposes.

Of special interest to food manufacturers is the plan of a ventilating plant in a biscuit factory, embodying viscous filters. 1,200,000 cubic feet of air per hour pass through the station, filtered and delivered to each room. The outlets are arranged to promote an equable atmosphere. The air may either be recirculated, drawn from outside, or a mixture of the two.

The Atmosphere Control Co., Ltd., has also sent us a 14-page booklet entirely devoted to air conditioning in food manufacturing establishments.

This booklet is profusely illustrated, and its contents cannot fail to be of interest to food manufacturers of all kinds.

The booklet may be obtained free from the company, at Lloyds Chambers, Hobson Street, Cambridge.

Butter *versus* Margarine

Mr. C. E. Clear (right) is seen receiving a £5 prize from Mr. J. P. Van den Bergh, managing director of Van den Berghs and Jurgens, Ltd., makers of Stork Margarine. Mr. Clear was the only person out of 600 to distinguish margarine from butter, tasting 16 samples in a public competition.

Can the average person tell the difference between butter and margarine, by tasting? Van den Berghs and Jurgens, manufacturers of "Stork" margarine, thought not, so they organised a competition.

Samples of butter and margarine were displayed at the Food and Cookery Institute, London, and the public were invited to come in to taste and identify the samples. Five pounds was offered for the first all-correct solution, and one pound for all others.

There were 16 plates of bread fingers to be sampled; some white, some brown, some currant. They were spread with unsalted butter, salt butter, unsalted margarine, and salt margarine. The job was to sort out butter from margarine.

During four days, over 600 people entered for the competition. They included a wine taster, a tea taster, doctors and chefs. Only one, a man, succeeded in identifying all 16 samples correctly. He was Mr. C. E. Clear, of Shepherd's Bush, London, W. 12.

When Mr. Clear was presented with his prize, he was challenged to repeat his performance, the same prize being offered. He just failed, getting only 15 right out of the 16.

Health Exhibition, Portsmouth

We have received particulars of the exhibition of the Royal Sanitary Institute to be held at Portsmouth in July, 1938, which is arranged in connection with the Health Congress, and is attended by representatives of municipal and other authorities from all parts of the world, members of the various trades and professions in and around Portsmouth, interested in the exhibits, and the general public.

The applications for space already received at 90, Buckingham Palace Road, indicate a successful exhibition, as seems always to be the experience of the Royal Sanitary Institute.

* * *

B.I.F. Attendances

The final attendance figures for the 1938 British Industries Fair showed an increase over 1937 in all sections except in the general public's support of the two London centres, Olympia and Earl's Court. Here there was a decrease of nearly two thousand over the 1937 figures of 36,617. The Home and Overseas buyers, however, increased by 3,008 over the 1937 total of 186,781 in this section.

At Birmingham where the attendances were grouped as one there was an increase of 3,794 over 152,649 in 1937.

* * *

Vitsu Modernise

The pack for Vitsu, ready-to-use fresh beef suet marketed by Suvit, Ltd., has been redesigned by "Metal Box".

With a display outer, holding thirty-six packets, to match, it forms a compact counter display unit. A black-and-white scraper board reproduction of the firm's trade-mark replaces the former coloured drawing. Backed by a well-balanced lettering design in red, white and buff, the exclusive pack suggests the quality of the contents. The same colours are used in the outer, which is topped by a cut-out reproduction of a Vitsu-made suet pudding.

* * *

Honoris Causa

Mr. A. J. C. Cosbie, A.I.C., A.R.C.Sc.I., chief chemist at Truman, Hanbury and Buxton's Spitalfields brewery has been awarded the degree of B.Sc., by the National University of Ireland. Mr. Cosbie is, of course, Chairman of the British Association of Chemists and is more than well known in the brewing industry.

I Tell Britain!

J. A. Whitehead is a director of an enterprising, seven-year-old organisation called Copo, Ltd. He has sent a book in which he outlines the work of his concern. After pointing out the tremendous expenditure of the Government on armaments he asks why there should not be a general trend back to the land so that more than the present one-twenty-fifth of England's population should be engaged in agriculture. He quotes Napoleon's axiom, "An army marches on its belly", and says that his ambition is to make agriculture Britain's fourth fighting arm.

The idea is that Copo, Ltd., should, with public support grow more food in England and sell it here. A subscriber pays so much for, say, the planting of apple trees. Copo, Ltd., undertake to plant and look after these trees and then sell the fruit when the trees produce it, and return so much profit to the subscriber. By this means employment for farm workers is created and some tangible result from the "Back to the land" cry becomes evident.

It is a commendable effort and one which, perhaps, may cause some repercussions in the food industry, certainly the figures quoted and the growth of Copo, Ltd., outlined are most interesting and enlightening.

* * *

Unique Factory Flooring

Heavy trolleys continually passing over a concrete factory floor cause attrition and disintegration and at the same time the question of the action of acids, oils, etc., must be faced. The Butterley Co., of Derby, make a revolutionary method of flooring, a system of iron paving which disposes of this problem. As is shown in the above picture this has been successfully applied in a food factory, the biscuit making concern of W. and R. Jacob and Co., of Aintree. Here it is claimed that the system is hygienic and non-dust creating, permanent and mechanically true, so much that vibration to fragile unpacked biscuits during transit is greatly minimised.

Centrifugal Purifier

The new Lang centrifuge.

The food manufacturer's problems such as the removal of solids from liquids and the other manifold purposes for which a centrifuge is required, have been solved in an efficient and up-to-date manner by the introduction of a new type of centrifugal purifier-de-aerator (Type 300) by Lang (London), Ltd. The makers emphasise that it is not a hydro or basket centrifuge. Interesting points about this machine are (*a*) the fact that it does not aerate, (*b*) its discharge pressure up to 22 lbs. per sq. inch, (*c*) its sediment holding space of 13 gallons.

* * *

New G.W.R. Chief Accountant

The Great Western Railway announce the appointment of Mr. C. R. Dashwood, O.B.E., Assistant General Manager, to the position of Chief Accountant in succession to Sir Ralph Cope, who retired at the end of March.

* * *

Engineering Education

An unusual sort of prospectus has been sent by Loughborough College regarding their courses in chemical engineering. It is well produced and well illustrated; unexpected features in a college prospectus and unusual for this reason. If the book is a criterion of the excellence of the college then certainly the food industry can expect efficient manufacturers of their plant in the future.

Corrugated Containers

The complicated problem of industrial transport brings with it that of packing; particularly is this the case with food manufacturers, many of whose products live in glass bottles which call for extra care and protection during transit. Corrugated containers have been in use for many years, but it is perhaps not fully realised that recent advances in the construction of these containers has revolutionised packing methods.

At a recent display of such containers given by Eburite Corrugated Containers, Ltd., these advances were fully evident. The actual manufacture of the corrugated board was pictorially outlined, and the principle which gives such strength to the boxes was explained. A great advantage lies in the fact that Eburite containers lie flat until opened out for use, thus obviating the waste of storage space as with wooden packing cases. An interesting selection of the varied goods packed in these containers includes such diverse items as bottles of hair cream, disinfectant, cosmetics, paints, oils, polishes, soaps, pottery, bird cages, telephones, radios, and vacuum cleaners. Standard lines are, of course, available, but normally the containers are devised for each product—thus it is possible to have a case holding 13 bottles with safety and security. Those interested in packing goods of any description will be well advised to study the many advantages of lightness, strength and economy provided by Eburite Corrugated Containers.

* * *

Hot Water Direct from Steam

A mixing valve known as the Leonard Thermostatic Mixing Valve has recently been put on the market by Walker, Crosweller and Co., Ltd., Cheltenham, Glos. The makers claim that this valve will mix steam and cold water and deliver, silently, a supply of hot water which is thermostatically controlled.

The relative pressures of the steam and the cold water need not be equal, but it is recommended that the steam pressure be below the water pressure.

This has particular interest in view of the requirements of the new Factory Act for the provision of hot water washing facilities. Such a valve is also of use for washing down and has, indeed, many obvious points of application.

As a matter of interest a number of these valves will be installed at the pavilion of the Scottish Milk Marketing Board at the forthcoming Glasgow Exhibition.

Similar valves are also obtainable for mixing hot and cold waters at different or varying supply pressures.

Correspondence

Growing Food Without Soil

The Editor.

DEAR SIR,

Professor A. C. Pillsbury, of the Department of Botany, University of California, at Berkley, has been experimenting for several years on growing plants imbedded in wood shavings ("excelsior") or moss held on a wire network above tanks of water containing chemicals in solution. The roots grow down into the solution.

I have had the benefit of hearing Professor Pillsbury lecture on this subject in the Field Museum of Chicago and take pleasure in enclosing a pamphlet, *Chemical Gardens and How to Care for Them*, published by the Chemical Garden Company, 555, Asbury Avenue, Evanston (a suburb of Chicago), Illinois. It will be noted that this company is advertising Professor Pillsbury's book, *Picturing Miracles of Plant and Animal Life*.

Another publication by the same author gives exact formulæ for preparing the solutions, which require a large number of chemicals for each. Unfortunately I cannot refer to it by title, but I recall securing it directly from the Department of Botany of the University of California.

Truly yours,
WILLIAM A. BACHE.

CHICAGO, ILLINOIS.

The Editor.

DEAR SIR,

Re the query of your Dublin correspondent in connection with "Growing Food without Soil" I herewith give him my experiences in this particular study. Like him, I have sought through several sources for any information on this subject, but can get no really concrete evidence of any work having been done outside the research stations. My own experience has chiefly been with the growing of tomatoes.

I commenced my experiments with a solution based on the percentage of *available* plant foods in a soil, not the total.

Your correspondent will find that a mixture of such substances as ammonium phosphate, potassium sulphate, sodium nitrite, magnesium chloride, iron tartrate, and lime water a fairly good solution for starting off with, and as he proceeds he can introduce other substances.

The containers to use are shallow metal or concrete tanks, about 8 inches deep, covered with fine mesh netting.

The solution is kept at a temperature of about 70° to 80° F. by means of immersion heaters, and the plants are supported by means of twine.

As growth increases the solution is made slightly stronger, but do not overdo it so long as growth is proceeding satisfactorily.

Trusting that this information will be of use,
I remain,
Yours sincerely,
ROBERT PORTER.

GLASGOW.

The "Yeoman" Movement

To the Editor.

DEAR SIR,

If there is one thing that strikes the reader of your efficient, up-to-date journal it is the fact that this country has brought "food manufacture" to a fine art. But even the excellent organiser, however competent, needs the basic raw materials—meat, wheat, fats and fruits—to produce his supplies to feed the people.

To-day imported foodstuffs are no longer safe and secure as in former days when our Navy stood before the world as a two-to-one force. We must not forget that the submarine nearly brought us to our knees, at a time when we were supported by the combined Navies of the whole world, during the late war with Germany.

To-day the Air Force is a more deadly foe than the underwater enemy, it is ubiquitous and instantaneous in attack, and no slow-moving convoy can be immune from its power dives.

The clear-headed food manufacturer has surely thought of this danger, and we are convinced that if he saw a loophole whereby he could escape from this catastrophe he would do so.

Unfortunately here we come to that inscrutable, difficult thing—politics, and here the bravest board of directors throw up their hands in utter despair.

But if these industrial magnates grasped that there has come into being an organisation, the "Yeoman Movement", striving to press upon the Government the need for a great new agrarian policy, they would, we feel sure, throw their whole heart into such a scheme, especially as it has a draft Parliamentary Bill of seven clauses ready for the Statute Book.

If once this policy became the law of the land it would establish, during a five-year period, 500,000 modernised, up-to-date yeoman homesteads on good land now lying derelict, and which might be visualised as a strip of intensively cultivated land occupying five miles wide, stretching from the south coast of England to the middle of Scotland.

This new community of yeoman families would be given ideal farms, in villages, with their dairy, bacon factories, machinery depots and grading and selling centres. These new yeoman farmers would be required to go through a probationary period of two years on a wage, and when they qualified they would be given their homestead on a 3 per cent. capital, ¾ per cent. reducible mortgage and ½ per cent. maintenance basis.

These intensive cultivators would produce from land that now lies stagnant £250,000,000 of new, properly graded and packed produce, and from this new productive wealth the country would derive a new internal trade of three to four times this amount—*i.e.*, £750,000,000 to £1,250,000,000—which is two to three times more than the shrunken and highly precarious export trade which we are trying to live upon to-day.

Surely such an organisation, the "Yeoman Movement", is vital not only to the "food manufacturer", and to the whole life of our industries, but to every man, woman and child in the country?

How long will the apathy of democracy keep such blessings knocking at the door?

Yours faithfully,
E. HAMMOND FOOT.

WILTON CORNER,
WILTON CRESCENT,
BEACONSFIELD.

Institute of Physics

AT a meeting of the Board of the Institute of Physics, held on March 9, 1938, the following were elected to membership:

Fellows.—V. J. Francis, B.Sc., A.R.C.S.; A. C. Gunstone; G. E. Harrison, B.Sc., Ph.D.; A. S. G. Hill, B.Sc.; O. P. T. Kantorowicz, D.Ph.; R. R. Nimmo, M.Sc., Ph.D.; W. D. Oliphant, B.Sc.; S. Rodda, B.Sc.; J. Shearer, B.A., M.Sc.; A. E. Stevens, B.Sc., B.A.; H. Wilman, B.Sc., A.R.C.S., Ph.D., D.I.C.; A. Warmisham, M.Sc.

Associates.—W. J. Challens, B.Sc.; J. G. G. Conybeare, M.Sc.; F. T. Cotton, B.Sc.; C. Dodd, B.Sc.; A. Dunford, B.A.; L. Frank, Ph.D.; A. Hobson, M.Sc.(Tech.); G. G. Isaacs, B.Sc.; W. G. Osmond, B.Sc.; W. Railston, M.Sc.; A. H. Sully, M.Sc.; H. J. Ward, B.A.; J. R. S. Waring, B.A.

Subscribers.—C. R. Greenacre; B. M. S. Maxwell.

Students.—E. A. Bailey; G. F. Clough; R. G. Duce; A. Heathcote; R. Meakin, B.Sc.; S. T. Pickering.

NEW COMPANIES

Apple Growers' Association (West Kent), Limited. (336778). Feb. 12. To provide facilities for the storing, packing, grading, and marketing of fruit and other produce, etc. £5,000. Dir.: T. E. Wimshurst, Tibbs Court, Brenchley, Kent.

Benninga (Hull), Limited. (337007.) Feb. 19. Mnfrs. of and dlrs. in oils, seeds, nuts. Mnfs. of and dlrs. in margarine and other oil and fat products, etc. £50,000.

Buer, Limited. (336781.) Feb. 12. 82, Fetter Lane, E.C. 4. Meat mchts., butchers, etc. £1,000. Dirs.: Gladys W. Morgan, 9, Constitution Hill, Woolwich, S.E. 18; E. W. Clarke, 158, Brewer Street, Woolwich, S.E. 18.

Clarke and Bradbury, Limited. (336971.) Feb. 18. Schola Green Lane, Morecambe and Heysham. Manufacturing, wholesale, and retail confectioners, etc. £400. Permt. dirs.: Margaret Clarke, Four Walls, 428, Marine Road East, Morecambe and Heysham; E. P. Bradbury, Annie Bradbury, and E. R. Bradbury, all of 13, Lines Street, Morecambe and Heysham.

Ford Bank Products, Limited. (336824.) Feb. 14. Mnfrs. of and dlrs. in milk products, etc. £100. Permt. dirs.: J. E. Heald, Sharston House, Northenden, Cheshire; T. C. Heald, 16, Cedar Road, Gatley, Cheshire.

F. Granelli, Limited. (336786.) Feb. 12. 12, Hudson Road, Leeds, 9. Proprietors of milk and snack bars, etc. £1,000. Dirs.: F. Granelli, 47, Coldcoates Avenue, Leeds; O. Lusardi, 13, Cameron Street, Leeds; G. Lusardi, 50, Foundry Lane, Leeds.

J. Gwillim, Limited. (337133.) Feb. 23. Flour and provender millers and corn mchts. Coultershaw Mill, Petworth, Sussex. £10,000. Dirs.: Mrs. E. S. Gwillim, 408, Coultershaw, Petworth, Sussex; G. M. Gwillim, 50, Duneton, Petworth; W. E. Challen, Allendene, North Mead, Petworth.

Lake Lane Nurseries, Limited. (336888.) Feb. 16. 4, South Place, London, E.C. 2. Tomato, mushroom, and general vegetable growers and market gardeners, etc. £1,000. Dirs.: J. Aberson, Huize, Overwetering B.114, Olst, Holland; J. Aberson, junr., Chantrys, West Barnham, Sussex; F. Fyles, 7, Sandringham Gardens, Crouch End.

W. R. London (Phosphates), Limited. (337000.) Feb. 18. Victoria Works, Stanmore Avenue, Marton, Blackpool. Mnfrs. of and dlrs. in flour, yeast; bakers' sundriesmen, etc. £1,000.

George Morris (Blackpool), Limited. (336566.) Feb. 5. 6, Castlegate, Lytham Road, Blackpool. Bakers and confectioners. £2,500. Permt. dirs.: J. W. Lee, 714, Devonshire Road, Blackpool; C. S. Hays, 1, Berwick Road, Blackpool; Dr. H. F. Overend, 1, Woodstock Gardens, Blackpool.

Mossley Pork Company, Limited. (336622.) Feb. 7. 3, Victoria Park, Liverpool. Cooked meat manufacturers, etc. £550. Dirs.: T. Gillespie, 3, Victoria Park, Liverpool; J. Weir, 86, Priory Road, Liverpool; C. G. Brown, 7, Chudleigh Road, Stanley, Liverpool.

Murray and Company (Eastbourne), Limited. (336579.) Feb. 5. Mnfrs. and mchts. of and dlrs. in foodstuffs and food products, etc. £1,000. Permt. Dir.: C. Stanhope, 2, West Terrace, Eastbourne.

Rochdale Bye-Products Company, Limited. (336630.) Feb. 7. 36, Dale Street, Liverpool. Exporters and mchts. of and dlrs. in grain, corn and flour, etc. £5,000.

James Thornley and Sons, Limited. (332869.) Registered October 22, 1937. Warburton Corn Mills, Heatley, near Warrington. To take over the bus. of millers and corn and flour mchts. cd. on at Warrington as "James Thornley and Sons". Nom. Cap.: £14,000 in £1 shares (7,000 pref. and 7,000 ord.). Dirs.: T. Thornley, senr., Hill House, Heatley, near Warrington; T. Thornley, junr., Hill House, Heatley, near Warrington; F. Thornley, Hill House, Heatley, near Warrington.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.

TRADE MARKS

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

BIDCLAR. — 583,320. **Tea, coffee, and cocoa.** Frederick John Mulley, 65, Brentham Way, Ealing, London, W. 5.

BUGLE.—581,734. **Chocolate and chocolates, but not including chocolate biscuits.** C. Kunzle, Ltd., 156, Broad Street, Birmingham, 15. March 2.

CAROPHYLL.—582,409. **Substances used as food or as ingredients in food.** Thomas Sanderson, 30, Burdon Terrace, Newcastle-on-Tyne. February 16.

CASARGA.—582,925. **Substances used as food or as ingredients in food.** Argentine House, Ltd., King William Street House, Arthur Street, London, E.C. 4.

LES JEANNE D'ARC.—581,004. **Canned fish.** Gaston Chancerelle and Cie, 21, Rue Ernest-Renan, Douarnenez, Finistere, France. February 23.

MARMALAX. — 578,525. **Marmalade.** Nelson Preserving Co., Ltd., Nelson Factory, Long Lane, Aintree, Liverpool. (By Consent.) February 16.

QUAX. — 582,019. **Confectionery and biscuits.** Mars Confections, Ltd., Bay, 1, Dundee Road, Trading Estate, Slough, Buckinghamshire. (Associated.) January 19.

QUINAQUA. — 582,830. **Ice-cream powders.** Quinnette, Ltd., 33, Rushworth Street, Blackfriars, London, S.E. 1. (Associated.) February 16.

RENCHOCO. — 581,226. **Preparations of chocolate for use as food.** John F. Renshaw and Co., Ltd., Lock's Lane, Mitcham, Surrey. (Associated.) February 2.

SELECTED KIPPERS.—578,915. **Kippered herrings.** Andrew Johnson, Knudtzon, Ltd., St. Andrew's Dock, Hull. January 19.

SURMOUNT.—582,576. **Substances used as food or as ingredients in food.** W. B. Willey and Sons, Ltd., South Side, St. Andrew's Dock, Hull, Yorkshire. February 16.

UNOX.—582,015. **Milk and milk products (for food).** United Food Producers, Ltd., 46, Fish Street Hill, London, E.C. 3. March 2.

VELVUS.—582,474. **Edible oils and edible fats.** Loders Lard Refining Co., Ltd., 2, Kingscote Street, Tudor Street, London, E.C. 4. February 2.

VINTAGE.—582,427. **Marmalade.** Home Counties Dairies, Ltd., Central House, Finsbury Square, London, E.C.2. March 2.

VITAMA. — 581,398. **Ice-cream powder.** William Gardiner and Robert Gardiner, trading as William Gardiner and Co., 15, Biggar Place, Glasgow. March 2.

VORA.—580,147. **Flour, baked articles of food made from flour, and confectionery, but not including dried fruits.** Ben Worsley, Ltd., North End Bakery, Bogheight Road, Darwen, Lancashire. (By Consent.) January 12.

WELKIN.—582,475. **Edible oils and edible fats.** Loders Lard Refining Co., Ltd., 2, Kingscote Street, Tudor Street, London, E.C. 4. February 2.

574,763.—**Treacle for sale in Scotland, Northern Ireland, and the counties of Lancashire, Cumberland, Durham, Westmoreland, Northumberland, and Yorkshire.** Ingram Bros. (Glasgow), Ltd., 24/30, Sussex Street, Glasgow, Scotland. December 8.

User claimed from the year 1895. Section 21.

Registration of this trade mark shall give no right to the exclusive use of the word "Superfine" or of the left-hand panel device.

INFORMATION and ADVICE

Devonshire Cream Cheese — Vanillin Crystals — Dog Biscuits

Devonshire Cream Cheese

3,619. *As subscribers to your journal we should very much appreciate your forwarding to us a working formula for the manufacture of "Devonshire Cream Cheese". The goods we are desirous of manufacturing are similar to the St. Ivel Cream Cheese, which is manufactured somewhere in England. This cheese is somewhat like a semi-sour butter, and is usually sold wrapped in tinfoil and placed in a carton.*

Whatever information you can give us in regard to the manufacture of a similar cheese would be appreciated, and we thank you in anticipation. (Melbourne.)

In reply to your enquiry of January 21 with regard to the manufacture of cream cheese, we quote the following extract from a back issue of FOOD MANUFACTURE, which details directions for 100-lb. batches:

"Add 5 lb. of dry skim milk to 93 lb. of sweet cream testing 40 to 42 per cent. milk fat. Then add 0·5 lb. of ground sugar and 0·75 of salt. The cream should be well agitated as the dry skim milk and agar are slowly added. Pasteurise at 180° to 185° F. for 5 minutes. Cool to 110° F. Add 0·75 lb. of commercial starter. Homogenise at 3,500 lb. pressure, using no strainer in the intake pipeline. The homogeniser should have been previously run with water at 160° F. or above. Place the cheese immediately into the final package. Chill in a refrigerator at 40° to a temperature of 70° F. and incubate for 12 to 24 hours to develop an acid flavour. Then chill to and hold at 40° F.

The acidity develops slowly, and the rate of development is controlled by the percentage inoculation. Reducing the skim milk solids to 3 per cent. tends to soften the body of the cheese and increases the tendency towards some whey drainage and lower total acidity. The cheese may be softened by decreasing the homogenisation pressure to 3,000 lb. or firmed by increasing it to 4,000 lb. More than 1 lb. of salt will retard, and 1½ lb. almost check development. Cream colour may be added before pasteurisation, if desired, and it has the special advantage of reducing the intensification of colour of cheese exposed to the air.

Consideration has also been given to the omission of starter and the securing of the desired acid flavour from Neufchatel, cottage or Neufchatel cream cheese. The process itself presented no special difficulties (even cottage cheese could be homogenised in the cold or warm at 3,000 lb. pressure), and the mixture was treated in the regular way.

About 50 per cent. of this acid is required to impart a very mild flavour to the finished product; or a product such as that made from an enriched milk from the cottage cheese process could be homogenised alone. The process is somewhat complicated and the flavour of the finished cheese is very mild, but it has excellent keeping qualities.

The homogeniser may be a source of microbial contamination and may chill the first material passing through it. The cream mixture was passed through a coarse strainer with approximately $\frac{1}{16}$ in. openings, and the strainer to the homogeniser was always removed from the pipeline to permit an even flow of the cream mixture. Short pipelines are very desirable to reduce mechanical losses.

The hot cheese may be transferred with a filling machine or by hand to 3-lb. or 5-lb. lined boxes for bulk sale. The usual mayonnaise jar-filling machine can be used for filling jars, but some difficulty may be encountered in making the small tinfoil or transparent cellulose-wrapped 1- to 4-oz. packages. These packages are made from the cold cheese by moulding into proper size with a machine, or cutting into the proper size with a remodelled butter cutter. Some ingenuity must be used in the details of placing the cheese in the package."

This will serve as a basis for experiment.

Vanillin Crystals

3,543. *Are vanillin crystals the correct substance for imparting vanilla flavour (synthetic), and is it possible to dissolve the crystals in a solvent such as rectified spirits?* (Hants.)

Vanillin is used in flavouring, having a vanilla flavour. It is possible to dissolve the crystals in water, alcohol and ether.

Dog Biscuits

3,542. *Would you kindly supply me with a formula and baking instructions for the manufacture of a dog biscuit? A finished product is desired similar in appearance to the product "Shapes" as made by Spiller and Co. of England, with which you are no doubt familiar.*

I am concerned chiefly with the basic facts as to the type of flour, whether yeast or other leavening agent will be necessary to avoid the biscuits being too hard and brittle, amount of water and baking temperature, need for shortening, etc. While it is not my intention that the biscuit be a nutritionally complete food, it is possible that meat or bonemeal, linseed oil and other materials may be added only to an extent that the desirable physical features of the biscuit will not be destroyed. (Oregon.)

The subject you enquire about is a very complicated one. Generally speaking, these biscuits are made from weak flour, the leavening agent being baking powder. You will no doubt realise that the product of the firm you mention has been evolved by dint of very extensive research, the firm having a large staff of chemists. It is obvious that, having arrived at a satisfactory result, the processes are not broadcast.

We suggest that you get into touch with an independent expert, whose name we are giving you.

The name of the expert was given.

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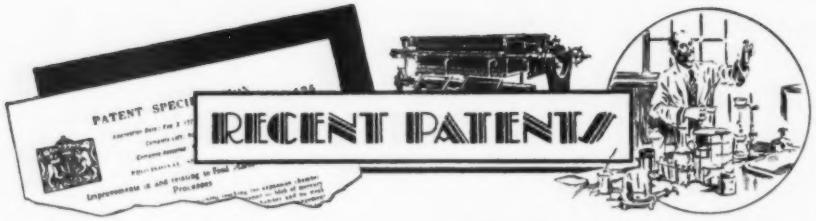

These particulars of New Patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The "Official Journal of Patents" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

4716. BARON: Foodstuffs. February 17.
4924. WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.: Treatment of meat. February 17.
5284. CROSSE AND BLACKWELL, LTD., JOHNSON, R. I., and CLAYTON, W.: Containers for foodstuffs. February 19.
5403. SUBMARINE SIGNAL CO.: Treatment of milk. February 21.
5408. OCEAN HUNGARIAN CONSERVE FACTORY AND TRADING CO., LTD.: Preparation of foodstuffs February 21.
5490. HALL, J.: Cooking, etc., of foodstuffs. February 22.
5601. SORNET, F., ETIENNE, G.: Preparation of condensed milk. February 22.
5602. SORNET, F., ETIENNE, G.: Manufacture of cheese. February 22.
5662. CROSSE AND BLACKWELL, LTD., SUMNER, C. G., JOHNSON, R. I., and CLAYTON, W.: Lacquering metal containers. February 23.
5663. CROSSE AND BLACKWELL, LTD., MORSE, J. T., SUMNER, C. G., JOHNSON, R. I., and CLAYTON, W.: Coating of metal containers. February 23.
5664. CROSSE AND BLACKWELL, LTD., SUMNER, C. G., JOHNSON, R. I., and CLAYTON, W.: Coating metal surfaces. February 23.
5665. CROSSE AND BLACKWELL, LTD., SUMNER, C. G., JOHNSON, R. I., and CLAYTON, W.: Coating metal containers. February 23.
5712. NEEF, F.: Foodstuffs. February 23.
5753. BARNSDALE, F. H.: Apparatus for heat treatment of cereals, etc. February 23.
29742. STANDARD BRANDS, INC.: Manufacture of baked goods. (United States, November 3, 1936.)
29754. ADAMS, C. F.: Containers for the cutting of cooked meats, etc.
30100. BRIOD, A. E.: Vitamin concentrates.
30174. REDLER, A.: Treatment of cereals, etc.
30212. LUCAS, LTD., J.: Cartons, etc.
30306. GOTHE, H.: Apparatus for shaping ice-cream. (Germany, November 4, 1936.)
30313. EVANS, F. M.: Funnels for pouring liquid into vessels.
30364. CARR, R. D.: Filling of containers with liquid.

Complete Specifications Accepted

475,070. KODAK, LTD.: Method for the purification of animal and vegetable oils, fats, waxes, and therapeutic concentrates obtained therefrom. (July 10, 1936.)
475,148. WHITE, R.: Devices for filling bottles or other containers with fluids. (June 13, 1936.)
475,242. INTER-BREVEX AKT.-GES., and ERZINGER, J.: Apparatus for whipping cream, white of eggs, and the like. (March 9, 1937.)
475,352. INDUSTRIAL PATENTS CORPORATION: Preservation of egg whites. (August 22, 1935.)
475,642. BROOKE, BOND CO., LTD., and WOOD, C.: Machines for cutting manufactured tea and like dry substances. (July 23, 1936.)
475,661. MARCHINI, B.: Containers for freezing and conserving ice-cream or other substances. (May 29, 1936.)
475,739. GREENSLADE, W. R.: Pasteurising or sterilising apparatus. (May 22, 1936.) (Addition to 431,939.)
476,113. HANSFORD, B. H.: Machines for moulding or shaping sweets or the like. (June 2, 1936.)
476,116. IZONS AND CO., LTD., and CHESSHIRE, J. I.: Handles for cooking utensils. (June 13, 1936.)
476,200. GLUNZ, H. F.: Sealing containers such as milk bottles. (October 12, 1936.)
476,261. HOUNSELL (ENGINEERS), LTD., J., HOUNSELL, W., and HOUNSELL, F.: Coating of sweets and like products with sugar, flour, or like material. (June 10, 1936.)
476,449. JENKINSON, LTD., H., and JENKINSON, H.: Cartons and like containers for sweetmeats. (July 30, 1936.)
476,469. THON, C.: Smoking of foodstuffs. (January 28, 1936.)
476,540. MANTELET AND BOUCHER: Mills for grinding pepper, salt, sugar, coffee, and the like. (August 18, 1936.)
476,969. KING, R., and CURWEN, G.: Means for preparing sliced vegetables or fruits.
476,992. BERGNER, J. C.: Apparatus for cooking doughnuts and the like. (August 3, 1937.)
477,218. TRIGGS, W. W. (SWEETS LABORATORIES, INC.): Chewing-gum material and process for making same.
477,224. TRIGGS, W. W. (KRAFT-PHENIX CHEESE CORPORATION): Drying of whey.
477,235. MCGEHEE, W. L., and LUHNOW, H. W.: Manufacturing dried foodstuffs.
477,282. AUTOXYGEN, INC.: Art of refining edible oils, fats, and analogous products.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

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473,476. **Grading by weighing.** COOPER, C. E. T., and MURTON, S.

In an apparatus for grading apples, eggs, etc., wherein pivoted receptacles carried on balances mounted on a turntable cooperate with trip devices which cause the automatic ejection of the apples, etc., into grading bins, the turntable is mounted in a plane inclined to the horizontal. The turntable is mounted in an inclined position on ball bearings, and the balances are provided with tipping pans normally retained by catches. A roller on a downward extension of each balance is arranged to run along rails carried on a series of stationary balances of decreasing resistance. A second roller runs on fixed tracks bridging the gaps between the rails. A trip device is arranged adjacent each balance. In use an attendant places the articles singly in upper pans, and the weight of the articles causes the turntable to rotate. The roller of each balance bears successively upon the rails of the balances, and, if the weight of the article is sufficient, depresses the rail, and the catch descends so as to be displaced by the trip device. The pan then tips and discharges the article into a bin appropriate to the grade. Articles below a predetermined weight are carried forward and discharged by a further trip device.

474,666. **Preserving food, etc.** TOMKINS, R. G.

Citrus fruits—*e.g.*, oranges—are preserved by exposure to low concentrations of diphenyl in the vapour phase. The diphenyl may be introduced into the atmosphere of the chambers in which the fruit are stored, the composition of the atmosphere being also controlled, if desired, in respect of its oxygen, nitrogen, or carbon dioxide content and in respect of its temperature. The diphenyl may be vaporised into the fruit storage chambers. Alternatively, or in addition, the diphenyl may be applied to wrappers, containers, or other solid media with which the fruit may come into contact or are enclosed in their packing or storage, the diphenyl being applied, if desired, with diluents—*e.g.*, dissolved in mineral oil or paraffin wax or other waxy or oleaginous material. The provisional specification also describes the use of derivatives of diphenyl, including the phenolic and carboxylic derivatives such as the *o*-, *m*-, and *p*-phenyl phenols and the corresponding carboxylic acids and the halogenated derivatives of these compounds or of diphenyl. The storage of eggs in flats treated with *o*-phenyl phenol or its sodium salt or with paraffin wax containing 7 per cent. of *o*-phenyl phenol, or grapes enclosed in wrappers impregnated with *o*-phenyl phenol, and the dusting on of diphenyl or its derivatives over seed potatoes or other seed material not intended for human consumption is described.